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THE ACCURACY OF OUR SERVICE FIELD RANGE-FINDERS.

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THE degree of accuracy attainable in field range-finding has been hitherto commonly regarded as more or less a matter of individual opinion, or at best of individual experience: hence, while a variety of conflicting statements on the subject have been promulgated, no serious attempt has been made to test them by the precise methods proper to scientific investigation.

To remedy this omission in the case of the Service range-finders, I shall in this paper briefly examine the question by the aid of simple formulæ, from which tables of probable error may be calculated, and a standard of accuracy established for each range-finder. Until this has been done, it will be plainly impossible to appraise exactly the tactical value of these instruments, or to apply them with complete advantage in the field.

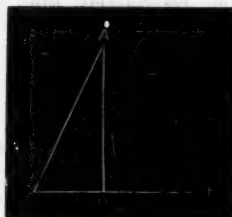
Our Service field range-finders are at the present time the Watkin for artillery and infantry, and the Weldon for cavalry and infantry. It will be advisable to consider these instruments separately.

THE WELDON RANGE-FINDER.

The Weldon range-finder consists of three prisms, reflecting respectively the following angles within manufacturing limits.

90°, 88° 51' 15", 74° 53' 15".

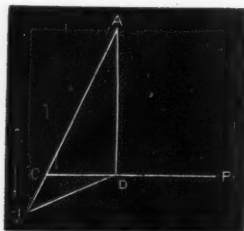
FIG. 1.



There are three ways of using the instrument:—

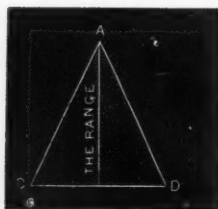
1st Method.—A being the *object* (Fig. 1) and AD the range required:—The angle $ADP = 90^\circ$ is found by the first prism, and the angle $ACD = 88^\circ 51' 15''$ by the second prism,¹ the point P being a *direction point* found on the ground, or set out for the purpose. Then CD being actually measured, the range = 50 CD.

FIG. 2.



2nd Method.—The triangle ADC (Fig. 2) is determined as before, but instead of measuring CD, and multiplying it by 50 to get the range, the third prism is made use of to make the angle $AFD = 74^\circ 53' 15''$. Then FC, the sub-base, being measured, the range = 200 FC.

FIG. 3.



3rd Method.—Two observers are required, each with a range-finder. They face one another, and, using the second prism, reflect the *object* on to each other respectively, thus making an isosceles triangle, ADC (Fig. 3), having the interior base angles at D and C, each $= 88^\circ 51' 15''$. Then CD (the base) being measured, the range = 25 CD.

Causes of Error.

The principal causes of error of range with the Weldon range-finder are—

¹ The angle C is sometimes determined first and the angle D afterwards.

1. Instrumental errors; that is to say, defects in the prisms.
2. Errors of measurement.
3. Inaccuracy in appreciating the angles.
4. Inaccuracy in appreciating the line.
5. Errors in marking the base points; that is to say, differences between the points as marked on the ground and as determined by the eye.
6. Errors through not holding the instrument at the proper inclination to the horizon.

1. *Instrumental Error*.—The Service regulations permit of a certain amount of variation (plus or minus) in the instruments supplied by contract. As an empirical factor, this may be taken to cause an error not exceeding—

By the 1st and 3rd methods, ± 1.5 per cent. of the range.

„ 2nd method, ± 2.5 per cent. of the range.

The instrumental error may however be ascertained for any given instrument, and its readings corrected by the addition or subtraction of so much per cent. from the range.

2. *Error of Measurement*.—With good measuring tapes, on flat ground and in the absence of high wind, this ought not to be more than $\frac{1}{200}$ of the length measured, so that the error of range due to error of measurement should not generally exceed ± 0.5 per cent.

3. *Inaccuracy in Appreciating the Angles*.—The smallest difference of angle appreciable by the naked eye is about 1 minute; that is to say, the angle subtended by 1 inch at 95.4 yards' distance. From this it follows that a faultless range-taker is liable to an error of 1 minute at each base point owing to imperfect estimation of the reflected angle.

4. *Inaccuracy of Line*.—Errors of line occur in the 1st and 2nd methods only. They can hardly be avoided on uneven ground,

FIG. 4.



where, as in the section, Fig. 4, the base points C, D, and the direction point P, are not in the same straight line.

5. *Errors in Marking the Points*.—These, unless large, are of consequence in the 1st and 2nd methods only.

If pickets are used, such that the instrument can be placed upon them in taking the angles, no error is to be expected; but if the points are roughly marked, important differences may exist between their actual and their true positions.

6. *Incorrect Slope of the Instrument.*—No estimate can be given of the amount of unavoidable error from this cause. It will be generally at a minimum on flat ground, and increase in proportion as the object and the direction point are respectively one above and the other below the level of the observer.

Formulae for Errors of Range due to Inaccuracy in the observed Angles irrespective of the Causes of such Inaccuracy.

Referring to Figs. 1, 2, 3, if any errors occur in the angles at D, C, F, the three drill formulæ—

$$\begin{aligned} AD &= 50 \text{ CD} \dots\dots\dots \text{1st method} \\ &= 200 \text{ CF} \dots\dots\dots \text{2nd} \quad ,, \\ &= 25 \text{ CD} \dots\dots\dots \text{3rd} \quad ,, \end{aligned}$$

will no longer hold good, and an error of range will be the result.

Let A = the true apex angle (Figs. 1, 2) = $1^{\circ} 8' 45''$,

B = the true angle CDF (Fig. 2) = $13^{\circ} 58'$,

F = the true angle AFD (Fig. 2) = $74^{\circ} 53' 15''$,

δ = error in the right angle ADP (Figs. 1, 2),

e = error in the $88^{\circ} 51' 15''$ angle, *i.e.*, when the second prism is used,

t = error in the third angle,

R = true range,

R' = apparent range as found by the drill.

Then by first method—

$$R' = 50 R (\tan (A \mp e) \pm \tan \delta) \dots \text{1st Weldon formula.}$$

By second method—

$$R' = 200 R \frac{\sin (B \pm e \mp t)}{\sin (F \pm t)} \{ \tan (A \mp e) \pm \tan \delta \} \dots \text{2nd ditto.}$$

By third method—

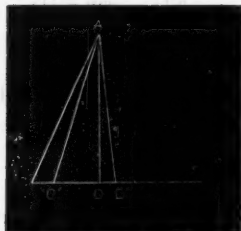
$$R' = 25 R \{ \tan (A \mp e) + \tan (A \mp e') \} \dots \text{3rd ditto,}$$

where e' = error made by the second observer.

The upper signs are to be taken when the increments δ , e , t are positive, that is, when the errors they express are of *excess*, and *vice versâ*.

These formulæ are easily proved. The first covers four general cases which can be examined separately; for example:—

FIG. 5.

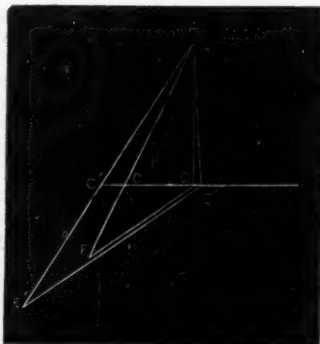


Let ADP , Fig. 5, be greater than 90° , and $AC'P$ greater than $88^\circ 51' 15''$, ADC being the range-finding triangle as it ought to be.

$$\begin{aligned}\text{Then } R' &= 50 \text{ } C'D', \text{ by the drill} \\ &= 50 (DC' + DD') \\ &= 50 \{AD \tan DAC' + AD \tan DAD'\} \\ &= 50 R \{\tan (A - e) + \tan e\}.\end{aligned}$$

The second formula covers eight general cases, which also may be examined separately.

FIG. 6.



For example:—let AFD (Fig. 6) be the true range-finding triangle with reference to the direction point P , and let

$$\begin{aligned}ADP &\text{ be greater than } 90^\circ, \\ AC'P &\text{ be less than } 88^\circ 51' 15'', \\ AFD &\text{ be less than } 74^\circ 53' 15'',\end{aligned}$$

so that

$$\begin{aligned}\delta &\text{ is } +, \\ e &\text{ —}, \\ t &\text{ —}.\end{aligned}$$

Then

$$R' = 200 F'C' \text{ by the drill.}$$

But by trigonometry $\frac{F'C'}{C'D'} = \frac{\sin F'D'C'}{\sin C'F'D'}$,

Now
$$\begin{aligned} F'D'C' &= AC'D' - C'F'D' \\ &= (ACD - e) - (CFD - t) \\ &= (ACD - CFD) - e + t \\ &= CDF - e + t \\ &= B - e + t. \end{aligned}$$

Again
$$C'F'D' = CFD - t = F - t.$$

Therefore
$$\frac{F'C'}{C'D'} = \frac{\sin (B - e + t)}{\sin (F - t)}.$$

But $C'D' = R (\tan (A + e) + \tan \delta)$. (See proof of Formula 1.)

Therefore

$$R' = 200 F'C' = 200 R \frac{\sin (B - e + t)}{\sin (F - t)} \{ \tan (A + e) + \tan \delta \}.$$

The proof of the third formula is obvious.

Extension of the Formulæ.

The three general formulæ just discussed can be made to cover the whole of the six causes of error enumerated at p. 691 by giving the proper value to δ , e , and t , but it will be convenient to treat the following separately.

Instrumental Error.—This will be best dealt with by adding to or subtracting from the error in range a quantity equal to the full allowable error per cent. of range, if the *liability* to error is under consideration, or half that amount if the *average* error of a number of instruments is in question.

Error of Measurement.—The proportion of the error of measurement to the length measured, be it base or sub-base, will express the percentage of the resulting error of range: thus a yard error in a base of 100 yards will cause an error of $\frac{1}{100}$, i.e., 1 per cent. of the range; 1 inch in a sub-base of 2 yards will cause an error of $\frac{1}{2 \times 36} = \frac{1}{72}$, i.e., 1.39 per cent. of the range; and so on; so that the effect of an error of measurement can be best treated independently, and, as will be seen further on, may be made to include certain errors of marking equivalent to errors of measurement.

Error through Wrong Inclination of the Instrument.—This is often very serious, but as it is an extremely variable factor it will not be taken into account at all in what follows.

There remain then three distinct forms of error, viz.:—

- Inaccuracy in appreciating the angle.
- Errors of line.
- Errors of marking.

The first is directly dealt with by the formulæ. The other two require to be translated into their angular equivalents.

Angular Equivalents of Small Errors of Line.

1. If an error in direction be made at right angles to the true primary base, and this error being measured at the right angle point amounts to a length a , D being the distance to the direction point, then the resulting errors of range will be given by adding—

$$\pm \tan^{-1} \frac{a}{D} \text{ to } \delta \text{ in Formula 1;}$$

$$\mp \tan^{-1} \frac{a}{D} \text{ to } e \text{ in Formula 2;}$$

the upper sign being taken when the deviation is towards the *object*, and *vice versâ*, provided the right angle is determined first. If the right angle is determined second, the rule for the signs will be reversed.

2. If an error in direction be made in laying out the sub-base at right angles to it, and this error, being measured at the 88° point, amounts to a length b , then the resulting error of range will be given by adding $\pm \tan^{-1} \frac{b}{R}$ to e in Formula 2 (independent of other corrections), the upper sign being taken when the deviation is towards the right angle point, and *vice versâ*.

Angular Equivalents of Small Errors of Marking.

Errors of marking must not be confounded with errors of line, though the effect may sometimes be the same.

1. *Errors at the First and Second Points.*—In Formulæ 1 and 2—let c be the linear deviation at the first point, at right angles to the primary base, D and R having their previous signification.

Then if the right angle point be the first determined,

$$\text{add } \pm \tan^{-1} \frac{c}{D} \text{ to } \delta;$$

but if the 88° angle point be the first,

$$\text{add } \pm \tan^{-1} \frac{c}{D + \frac{R}{50}} \text{ to } e.$$

The upper sign is to be taken when the deviation is towards the *object*, and *vice versâ*.

Again, if m and n are the linear errors in the direction of the base line at the 90° and 88° points respectively,

$$\text{add } \pm \tan^{-1} \frac{m}{R} \text{ to } \delta,$$

$$\text{and } \pm \tan^{-1} \frac{n}{R} \text{ to } e,$$

the upper or lower signs being taken according as m and n are made towards the *direction point* or from it.¹

2. *Errors at the Third Point.*—Small errors in marking the third points are of no consequence, except such as are in the line of the sub-base, and these are best treated as simple errors of measurement, and multiplied by 200 for the resulting error in range.

Application of the Formulæ.

We are now in a position to tabulate general results or work out the error of range in particular instances, and it may be useful to observe that for ordinary values of δ we may write $\tan(A - e + \delta)$ instead of $\tan(A - e) + \tan \delta$ in Formulæ 1 and 2.

The following will serve as examples.

Example 1.—A range-taker adopting Method 1 has marked his right angle point by placing his forage cap between his feet. In observing the angle, however, he has held the instrument exactly over his right foot.

The cap is 6 inches across, the range is 500 yards, and the direction point is a telegraph post about 48 yards from the right angle point.

The instrument is perfect, and all other operations are correctly performed. What is the error of range due to the inaccuracy of marking the first point?

Here

$$e = 0$$

$$\delta = +\tan^{-1} \frac{3 \text{ inches}}{48 \times 36} = 6 \text{ minutes.}$$

Therefore

$$R' = 50 \times 500 \{ \tan 1^\circ 8' 45'' + \tan 6' \} \\ = 544 \text{ yards.}$$

Hence the error amounts to 44 yards, or 8.8 per cent.

Example 2.—The direction point is a tree, the stem of which slopes 1 in 5 to the vertical. There are several knots upon it, and a range-taker makes his second and third points on a knot 2 feet 6 inches higher up than the one he looked at when making his right angle.

No other mistake is made. The range is 1,500 yards. The direction point is 95 yards from the second (88°) point. What will the error be?

Here in Formula 1, put $\delta = 0$, and since $\frac{1}{5}$ th of 2 feet 6 inches = 6 inches,

$$\text{take } e = \tan^{-1} \frac{6}{36 \times 95} = \pm 6 \text{ minutes.}$$

¹ Instead of adding $\pm \tan^{-1} \frac{m}{R} \pm \tan^{-1} \frac{n}{R}$ to δ and e in Formula 1, the error of range resulting from the errors m and n can be found independently; thus—

$$\text{Error} = 50(\pm m \mp n),$$

the upper sign being taken when m and n are towards the direction point.

Then $R' = 50 \times 1500 \tan 1^\circ 2' 45''$, or if e be negative $50 \times 1500 \tan 1^\circ 14' 45''$.

$$= 1,369 \text{ yards or } 1,631 \text{ yards.}$$

Therefore the error = 131 yards.

If the second method be adopted, put in Formula 2

$$\delta = 0,$$

$$t = 0,$$

$$e = \pm 6', \text{ as before.}$$

$$\text{Then } R' = 200 \times 1500 \frac{\sin (B \pm 6)}{\sin F} (\tan A \mp 6),$$

$$= 1,379 \text{ or } 1,620 \text{ yards,}$$

and the error will be 121 yards.¹

Example 3.—A range-taker marks his *third* point with his foot. He measures from his heel, whereas he holds the instrument exactly over his toe. His foot is 11 inches long, what is the error in range from this cause alone?

$$\text{Here the error} = 200 \times 11 \text{ inches}$$

$$= 61 \text{ yards.}$$

Example 4.—Two range-takers working together by Method 3, take the range to an Officer crossing their front at a quick walk. In making the observation one range-taker completes coincidence 1 second in time sooner than the other.

What is the error if the range be 1,000 yards?

At 4 miles an hour the distance walked by the Officer in one second would be 70.4 inches.

Hence the error can be obtained by multiplying by 25.

$$25 \times 70.4 \text{ inches} = 49 \text{ yards.}$$

Or it may be found by putting in Formula 3—

$$e = \tan^{-1} \frac{7.4}{36 \times 1000} = 6' 42'',$$

$$e' = 0.$$

$$\text{Thus } R' = 25,000 \{ \tan 1^\circ 15' 27'' + \tan 1^\circ 8' 45'' \}$$

$$= 1,049 \text{ yards.}$$

Error, 49 yards, as before.

¹ It will be noticed that the error here is diminished by the use of the third prism; that, however, is not invariably the case.

The following may be of interest :—

TABLE A.—*Greatest Variation in the observed Range attributable to the Optical Limit.*

Error = 1'	Method 1.	Method 2.	Method 3.
	Error per cent. of range will not exceed		
Occurs—			
In one angle only	1.45	1.54	0.73
In two angles.....	2.91	2.79	1.46
In three angles .....	..	2.92	..

In the above table it is assumed that the *instrument* is perfect, and that the *measurement*, the *line*, and the *marking* are absolutely correct.

The figures are obtained by making δ , e , t successively 0 and $\pm 1'$ in Formulæ 1, 2, 3, and tabulating the highest readings. It is evident of course that every value of error less than that expressed by the figures in the table may occur from zero in both directions.

Example 5.—A *faultless* range-taker with a *perfect* instrument takes the range of an object 1,000 yards away. What difference may possibly occur between any two readings by Method 1 or 2. Here by Table A the extreme error is $\pm 10 \times 2.92 = \pm 29.2$ yards, therefore 58.4 yards difference may occur in two readings.

Example 6.—A good range-taker is employed to find the distance of an object 1,500 yards away. Between what extreme limits ought his readings to be?

By Table B—

1st method 1,365 to 1,635.
2nd method..... 1,350 to 1,650.

Theory and Practice Compared.

It may be asked how far the conclusions arrived at theoretically tally with the results of experiment.

Now it happens that trials of a tolerably exhaustive kind were made at the School of Range Finding in 1884. Two instruments were used and there were three independent observers. Twelve observations were made at every range, three with each instrument by the first method, and three with each by the second, the mean being recorded in every instance. The country traversed was partly open, partly enclosed. The ground was in places rough and hilly, in others flat. Every kind of direction point was made use of.

TABLE B.—Maximum admissible Error in Range under favourable Service Conditions.

Range.	Method 1.				Method 2.				Conditions.
	Distance of direction point from first point marked.	Angles, line, and marking.	Measurement.	Instrumental error.	Totals.	Angles, line, and marking.	Measurement.	Instrumental error.	Totals.
	yards.	yards.	yards.	yards.	yards.	yards.	yards.	yards.	Per cent. of range.
1,000	50	91	5	15	111	101	5	20	126
									12.6
2,000	100	119	10	30	159	127	10	40	177
									8.8

1. Instrumental error not to exceed—
1st method..... 1½ per cent.
2nd method..... 2 "
2. Errors of measurement not to exceed $\frac{1}{30}$ of the base measured.
3. Inaccuracy in appreciating angles not to exceed 1' at each angle.
4. Errors of line not to exceed—
1st method .. 1 inch at 1st point.
2nd method .. 1 inch at 1st and 2nd points.
5. Errors of marking at each point not to exceed 1 inch at right angles to the desired line; 2 inches in the line itself or parallel to it.
6. Error due to the slope of the instrument, nil.

The following are the figures of the series in which pickets and measuring tapes were made use of :—

Range in yards.	Average error per cent. of range by 1st method.
Under 1,000	11.0
1,000 to 2,000	5.84

By the second method the error was about 1 per cent. greater than by the first.

Comparing these figures with those given in Table B, it would appear that the *actual average* error under *ordinary* conditions is not much less than the *theoretical extreme* error in *favourable* circumstances, but it must be remembered that in drawing up the table, no notice has been taken of errors from holding the instruments incorrectly.

THE WATKIN FIELD RANGE-FINDER.

The Watkin field range-finder is an instrument of the sextant type, measuring distances by the mechanical solution of a right angled triangle, and giving the result, without calculation, on a graduated cylinder. It can be used with any unit of length, so that there are no limits to the ranges taken, or to the bases made use of, except that the instrument is so constructed that the base must not be more than $\frac{1}{4}$ th, nor less than $\frac{1}{8}$ rd the range. It is fitted with a telescope giving an optical advantage of from 3 to 1 to 4 to 1.

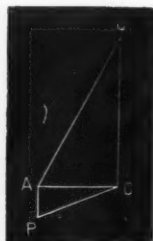
The physical conditions required are that (Figs. 7, 8), O being the object, two accessible points, A and C, may be found, such that the angle ACO may be a right angle, and the points A and O visible from C, and C and O from A.

No direction point is needed.

FIG. 7.



FIG. 8.



There are many ways of using the instrument, but the authorized drill for ordinary occasions is as follows :—

The observer having marked a point A (Figs. 7, 8), finds C at a convenient distance from it, the right angle, OCA, being determined by the instrument.

A sub-base, AP, having been set out, 3, 6, or 12 yards long, the observer standing at C reads off the length of AC (reflecting P on to A), and sets the instrument to that base.

He then proceeds to the point A, and from there reads the range on a graduated cylinder, by reflecting C on to O, which is equivalent to measuring the instrumental right angle less the angle OAC.

Causes of Error.

The common causes of error of range with the Watkin range-finder are—

1. Instrumental error, due to defective workmanship or to deterioration from wear.
2. Error in the sub-base.
3. Inaccuracy in appreciating the angles.
4. Difference between the base points as marked on the ground, and as determined by the eye.

Instrumental Error.—At present a total error, not exceeding 1 per cent. of the range, is permitted in new instruments, tested under standard conditions—that is, when the range is 20 times the base.

If from wear and tear the error increases to 2 per cent., the instrument is considered to be out of repair and is dealt with accordingly.

Error in the Sub-base.—The sub-base is laid out by a metallic cord, any alteration in which is corrected by comparison with a steel tape forming part of the equipment; the error in the sub-base should, therefore, in no circumstances, exceed $\frac{1}{200}$ th of the length laid out.

Unavoidable Inaccuracy in estimating the angles.—With the naked eye this may amount to one minute at each angle (see p. 691); with the telescope it should not exceed 20".

Difference between the Base Points as Marked and as Determined.—This error will occur if the instrument is held incorrectly with reference to the pickets.

When the Service artillery range-finding equipment is used, the error should be inconsiderable, because the large pattern range-finder is marked with a ring the size of the picket-head, and it is a part of the drill to rest the instrument on the picket and verify the angles, with the ring in exact position.

Formulae for Errors of Range.

Although a general formula can be given embracing every factor of error, it will be found convenient to deal separately with the errors of range arising from specific causes, as follows:—

1. Error in the sub-base.

Let b = the correct sub-base.

n = error in the sub-base expressed in the same units as b .

R = true range.

Then the error in range will be $-R \frac{n}{b+n}$, the proper sign being given to n Formula 1.

Thus if n be negative, that is, if the sub-base be too short, the error will be positive, or, in other words, the range read will be too long.¹

2. Error in appreciating the angle subtended by the sub-base in the secondary triangle.

Let t = error in the angle, considered to be positive when increasing the angle, and *vice versa*.

B = the correct base.

The error in the range = $-\frac{R}{B} \times \frac{B^2 + b^2}{B + b \cot t}$, the proper sign being given to t in each case²..... Formula 2.

Formula 2 can be proved thus:—

Let ϕ be the real angle,
 B' the base as read,

then, by trigonometry $B = b \cot \phi$,

and by the construction of the instrument,

$$B' = b \cot (\phi + t).$$

Therefore $B' = b \frac{\cot \phi \cot t - 1}{\cot \phi + \cot t}.$

$$\begin{aligned} B' - B &= \frac{b^2 \cot \phi \cot t - b^2}{b \cot \phi + b \cot t} - b \cot \phi \\ &= -\frac{b^2 + b^2 \cot^2 \phi}{b \cot \phi + b \cot t} = -\frac{B^2 + b^2}{B + b \cot t}. \end{aligned}$$

But $R' - R = (B' - B) \frac{R}{B}.$

Therefore $R' - R = -\frac{R}{B} \times \frac{B^2 + b^2}{B + b \cot t}.$

3. Error in appreciating the right angle and variable angle read at the base points of the primary triangle.

Let δ = error in the right angle, considered as positive when increasing the angle, and *vice versa*.

e = error in the variable angle, with the same convention.

¹ The corresponding error in the base itself will be $-B \frac{n}{b+n}.$

² The corresponding error in the base will be

$$-\frac{B^2 + b^2}{B + b \cot t}.$$

Then the error in range caused by these errors

$$= -\frac{R^2 + B^2}{R + B \cot(\delta + e)},$$

the proper signs being given to δ and e Formula 3.

Formula 3 can be proved in a similar manner to Formula 2. The variable angle referred to is the complement of the variable angle at the base of the primary triangle.

Corollary.—If i be the error in the instrumental right angle as distinguished from any error of appreciation—

FIG. 9.

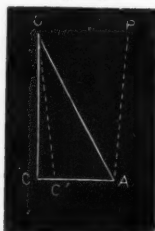
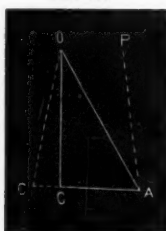


FIG. 10.



and ACO the true right angle (Figs. 9 and 10), it is evident that the variable angle OAP is increased or diminished by the same quantity, i , when the instrument is reversed.

Therefore in this case the error in range

$$= -\frac{R^2 + B^2}{R + B \cot 2i},$$

where i is to be taken as positive when it increases the right angle, and *vice versa*.

4. Error in the position of the instrument.

Let the instrument be held a length, a , out of position at the right angle in a direction towards or from the object, and similarly a length a' at the other point of the base, and let a or a' be considered positive when the picket-head is nearer to the object than the ring on the instrument.

Then if a , a' , are small, the error will be included in Formula 3 by adding a quantity k to $\delta + e$, where $k = \cot^{-1} \frac{B}{a + a'}$, the proper signs being given to a and a' .

Application of the Formulæ.

The formulæ we have established are:—

Watkin Formula 1.—Error of range due to error n in the sub-base

$$= -R \frac{n}{b + n}.$$

Watkin Formula 2.—Error of range due to error in appreciating the apex angle of the subordinate triangle

$$= -\frac{R}{B} \times \frac{B^2 + b^2}{B + b \cot t}.$$

Watkin Formula 3.—Error of range due to errors δ and e in the angles at the primary base points, together with incorrectness of position of instrument, a a' , at those points

$$= -\frac{R^2 + B^2}{R + B \cot (\delta + e + k)}, \text{ where } k = \cot^{-1} \frac{B}{a + a'}$$

the proper signs being given to n , t , δ , e , a , a' respectively.

A variety of examples may be worked out by means of the above as in the case of the Weldon formulæ, and it may be observed that for ordinary values of the angular errors we may substitute for the cotangent of the error the value of 1 divided by the error itself expressed in circular measure; thus for $\cot 1'$ we may write $\frac{180 \times 60}{\pi}$.

Example 1.—A 6-yard sub-base is laid out 1 inch too short. What is the effect on the observed range?

$$\text{Put } n = -\frac{1}{36} \text{ in Formula 1,}$$

$$\text{then the error} = \frac{1}{215} R,$$

that is to say, the error is 0.46 per cent. of the range, and has the effect of making the apparent range too long.

Example 2.—A careless range-taker holds the instrument $3\frac{2}{3}$ inches too far back when reading a range of 1,200 yards with a base of 60 yards. What error will this cause?

$$\begin{aligned} \text{In Formula 3 put } \delta &= 0, \\ e &= 0, \\ k &= \cot^{-1} \frac{60 \times 36}{3 \cdot 66}. \end{aligned}$$

$$\begin{aligned} \text{Then the error} &= -\frac{144000 + 3600}{1200 + 60 \times 590 \cdot 1} = -\frac{1443600}{36606} \\ &= -39\frac{1}{2} \text{ yards.} \end{aligned}$$

That is to say, the apparent range will be $39\frac{1}{2}$ yards too short.

The following tables correspond to those given at pp. 698, 699 for the Weldon instrument.

TABLE C.—*Greatest Variation in the observed Range attributable to the Optical Limit.*

Without telescope.

Error = 1'	Base 10 times the sub-base. Range 10 times the base.	Base 20 times the sub-base. Range 20 times the base.	Base 20 times the sub-base. Range 30 times the base.
Occurs in—	Error per cent. of range		
One angle only.....	0·29	0·59	0·86
Two angles.....	0·59	1·17	1·72
Three angles.....	0·88	1·77	2·27

If the telescope is used divide the figures in the table by 3.

Halving the figures in Table D for a working average, they agree closely with practice; the error of a fairly trained range-taker being found by experience to be about 1 per cent. after the instrumental error has been allowed for.

CONCLUDING REMARKS.

From the foregoing investigation into the common causes of inaccuracy with the service range-finders, it will be seen that it is quite practicable to obtain a precision sufficient for the requirements of active service. On the other hand, it is easy, by want of instruction or neglect of practice, to lose all the tactical advantage which the range-finder confers.

In the case of musketry and of riding we know that failure is not uncommon; so with range-finding; but surely the *best*, not the *worst* record, is the practical standard of merit. Want of skill in the handling furnishes no valid argument against the utility of any appliance, and the sooner this is generally acknowledged in respect to range-finders the better for the interests of the Service, and the less we shall hear of such unhappy performances as the over-estimation of an artillery range by 1,000 yards,¹ incidents more worthy of notice by court-martial than of record with the statistics of a campaign.

¹ See Military Prize Essay, R.U.S.I., 1887, Journal, vol. xxxi, p. 409. It should perhaps be mentioned that until the end of 1883 there were no trained range-takers in the British Army, and but few unbroken range-finders.

TABLE D.—*Maximum admissible Error in Range under ordinary Service Conditions.*

Relation of range to base, &c.				Separate errors.				Totals.		Conditions.		
How taken.	Range.	Base.	Sub-base.	Angles and position.		Measurement.		Instrumental.			Including instrumental error.	Excluding instrumental error. ¹
				yards.	yards.	yards.	yards.	yards.	yards.				Per cent. of range.	Per cent. of range.
Without telescope.	1,000	60	6	19.9	5.0	12.6	37.9	3.8	24.9	1. Instrumental error not to exceed $1\frac{1}{2}$ per cent. when R=20B.	2.7	
	2,000	100	"	45.3	10.0	30.0	85.3	4.2	55.3	2. Error of sub-base = $\frac{1}{100}$.	3.1	
	3,000	120	"	80.7	15.0	58.1	153.8	5.1	95.7	3. Error in appreciating each angle not to exceed —	1.6	
With telescope.	3,000	120	6	34.2	15.0	58.1	107.3	3.6	49.2	Without telescope..... 1' 0"	2.2	
	4,000	125	"	54.4	20.0	95	169.4	4.2	74.4	"..... 0 20.	1.8	
	5,000	125	"	84.6	25.0	156.7	266.3	5.3	109.6	4. Error in position of instrument on the picket-head not to exceed $\frac{1}{4}$ inch at each angle.	1.5	
With telescope and double units.	5,000	200	12	50.7	25.0	96.9	172.6	3.3	75.7		1.6	
	6,000	"	"	69.1	30.0	140.5	239.6	3.9	99.1			

¹ The instrumental error of every artillery range-finder is ascertained periodically, and recorded in the history sheet of the instrument kept by the battery to which it belongs.

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Friday, June 3, 1887.

GENERAL SIR BEAUCHAMP WALKER, K.C.B., Vice-President, in
the Chair.

MAIGNEN'S PATENT INDIAN "MUSSUCK" FILTRE
RAPIDE.

By Mr. P. A. MAIGNEN.

In the Crimean War, the Russian Army lost between 60,000 and 70,000 men in fight, and more than one million from disease, mostly due to bad water.

In the Turkish War of 1878, Russia again lost between 13,000 and 14,000 men in fight, and 70,000 from disease.

In the various campaigns in which France took part, five medical Officers died violent deaths (two being burnt alive), and sixty perished miserably of cholera and typhus.

When Sir Frederick Roberts arrived in Burmah to assume the command in chief of the Army, he found 45 per cent. of the troops on the sick list, the greater number owing to the use of bad water.

Dr. Parkes, in his book on hygiene, quotes a very large number of cases of epidemics amongst the troops in India, these epidemics disappearing immediately the source of the water supply was changed.

In Spain last year, during the cholera epidemic, the towns in which all the hygienic arrangements were deficient, but where the water supply was good, did not suffer, whilst where the water was bad, and notwithstanding the best sanitary precautions had been taken, the cholera epidemic was most intense.

Dr. Koch observed at Marseilles, that the cholera was much worse after rain than it was before. This is a fact well known to all who have resided in tropical climates. The reason is not far to seek. The Royal Commission on River Pollution has pointed out that half-a-pint of water condenses out of 3,373 cubic feet of air; that the rain in its fall brings down with it all the dust and germs of disease contained in that air, so that in drinking one single tumbler of water, we take in one moment into our system as many germs of disease as would enter the lungs by inhalation in a whole week. Thus after rainfall, the water has not only brought with it the impurities of the air, but also those that it has met with on the surface of the ground and in watercourses.

Sir John Lister has been knighted for introducing the system of dressing wounds, so as to exclude the dust of the air from entering the blood of the patient through those wounds; yet we swallow, without a moment's hesitation or thought, whole bucketfuls of water, which goes immediately into the circulation, carrying with it thousands, nay millions, of germs of every sort.

Someone on hearing this may say that it is a wonder that any of us are alive! and so it is. Nature has provided us with a certain strength which enables us to resist *some* of the attacks of the microscopical and ultra-microscopical world. But often that strength is not sufficient to enable us to overcome the attack; in any case, many of us drag on a miserable sickly life, caused through our own fault; we have allowed the enemy to enter the system, weaken us, and play with us, as a cat plays with a mouse.

The Burdon-Sandersons, the Tyndalls, the Pasteurs, the Kochs, the Kleins, and others, have followed these germs in the air, in the water, and in the animal system. Quinine and like remedies are administered to poison these germs. Is it not surprising that so little has hitherto been done in attempting to deal with these impurities in the water, before entering the system?

I had the honour of reading a paper at the 6th International Pharmaceutical Congress at Brussels two years ago. Over 700 chemists were there, representing twenty-two different States and I do not know how many learned societies. Two whole days were spent in discussing the question of finding out the nature and quantity of the different impurities in water. Resolutions were passed declaring that water which contained more than a given quantity of organic matter, or of inorganic matter, should be condemned as unfit for consumption.

After reading my paper on the filtration of water before this Congress, and noticing the interest taken by each member in the experiments I made, a thought took strong hold of my mind—it was this. Here are 700 chemists, all men of note, knowing well that impure water is the cause of numberless diseases, yet not one of whom made a single proposition as to the means of removing those impurities which they condemned. What is the use of telling the authorities of a town, or a firm, or private individuals, that their water must not be used, if they have no other source, and if they have no means of purifying it? I have even heard men—not entirely unknown—say—"if you filter bad water, and render it drinkable, it will prevent the authorities searching for better sources!" The absurdity of this argument is apparent; any system of purification must cost something, and it is possible sometimes to find good sources, but where these good sources are not available, it seems to me most urgent that all our efforts, as men of common sense, should tend to one object, namely, the finding out the best means of eliminating from the only available water, all its impurities.

For the last year or two we have been told to boil the water we have to drink, and many have done so religiously; but take the case of the traveller, or the soldier in a campaign—how is he to boil the

water, and wait till it cools? Again, if I mistake not, Dr. Frankland and Professor Tyndall positively state that many of the germs of disease are not destroyed by boiling; and it may not be known to all here present that water decomposes more quickly the longer it has been boiled—that is, that if the water has been boiled for half-an-hour, it becomes putrid in two days, if boiled for two hours it becomes putrid in one day.

General Viscount Wolseley, when organizing the Egyptian Campaign, had a strong appreciation of the necessity of purifying the drinking water for the troops, and it was upon his suggestion that the War Office sent out a sufficiently large number of suitable filters for all the men under his command, and we may say, after Dr. Quaine, of Netley, that Lord Wolseley did, by this thoughtful precaution, save more lives from disease than any other General has ever done by all other precautions.

Until lately, filters were supposed to remove matters in suspension only, and even then imperfectly, and only on the condition that large quantities of filtering medium were used. The transporting and keeping these filters in order was an insuperable difficulty. Thanks, however, to the invention of my friend Mr. John Bell,—by which he has been able to manufacture pure asbestos cloth,—I have been able to adopt this imperishable tissue to the various forms of filters which you see before you, and to obtain the results which I am about to show.

One great advantage of this asbestos tissue, besides its lasting properties, is that it has led me to use an extremely fine filtering medium in the shape of powdered charcoal, which has the effect of removing from water not only the suspended matters, but also of oxidising, and otherwise arresting matters in solution, such as urine and lead.

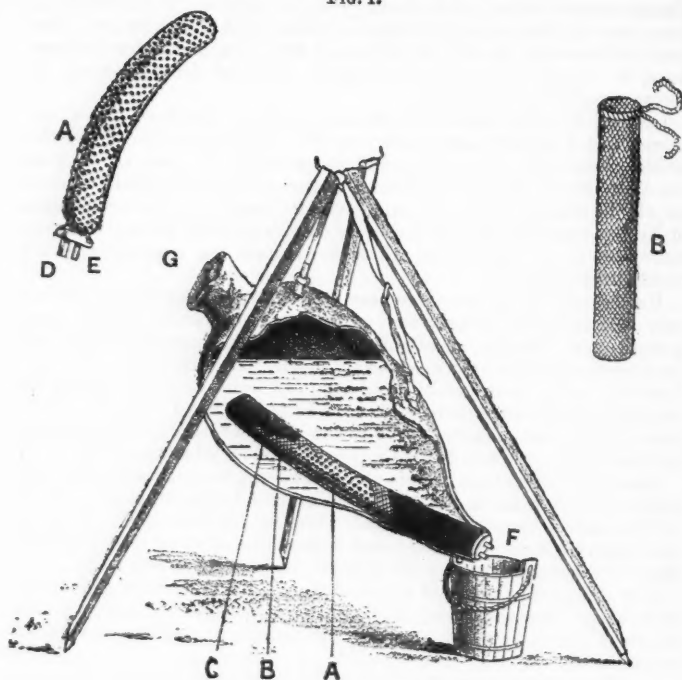
For India we take our charcoal from the mineral kingdom, so as to respect the caste prejudices of the natives, but I may say that the wood charcoal manufactured by the natives themselves would give good results.

I will now proceed to show you the various forms of filters designed to meet the requirements of the troops serving in India, Egypt, and other tropical countries.

I am indebted to Lieutenant-General Gloag, late R.A., for a most valuable suggestion, the result of which is before you, viz., the application of my process of filtration to the native "Mussuck." I am sorry that I have not been able to procure some of the native manufactured skins, which are far better adapted for the purpose than any skins I could obtain in England, but this will suffice to show the ease with which these skins can be converted into filters. It may interest some of my hearers to know that the name of Bheesty was given to the man who carries the "Mussuck," from a Persian word, "Bihisht," signifying "Paradise," thus showing the value natives of tropical lands place upon these water carriers.

It is well known that the "Mussuck," as at present used, is liable to become very foul because there is a certain difficulty in cleaning it, and then often the water, which came out of it, was more dirty than when it went in.

FIG. 1.



The improvements in the "Mussuck" filter may be summed up under three heads:—

1st. Water that goes in impure comes out pure.

2nd. The "Mussuck" is easier to clean through having an opening at both ends.

3rd. It can be used with ease, not only on the bheesty's back but also on the tripod, as shown here, or hung on the branch of a tree, or in any other available way, and water can be poured in at one end and drawn off at the other without fatiguing the man.

We have here some English-made chatties, in which we have placed filtering frames similar to those on the table. In India these vessels are used in all barracks, married quarters, hospitals, and kitchens for soldiers, and cost but a few pence, and we propose to send out simply the filtering frame, covered with asbestos cloth, to be fitted by the natives themselves in their own chatties, they using also their own wood charcoal—in another chatty we have placed one of

these frames so as to make a syphon—this of course requires no fitting, but simply a starting of the syphon.

Fig. 1 represents the "Mussuck" converted into a "Filtre Rapide." To effect this, a perforated metal filtering frame, A, with outlet, D, and air vent, E, covered with an asbestos cloth, B (tied on the frame with asbestos cord), is inserted in the mouth of the "Mussuck" at F. The mouth, after the insertion of the frame, is firmly closed over it by means of leather thongs, the usual method adopted by the natives themselves when using the "Mussuck" without the filter. An opening at G, which is the only alteration made in the native "Mussuck," allows of the rapid filling of the "Mussuck," either when carried by the bheesty or when suspended on a tripod, as in the diagram, or on the branches of a tree, or on the shaft of a carriage.

To Prepare it for Use.—Mix half a pound of powdered charcoal with the first supply of water poured into the "Mussuck" at G. Some of the charcoal will adhere to the asbestos cloth, as shown in C, and effectually close its pores so that no impurities whatever can pass through—the remainder, by being agitated in the water, gives it an additional degree of purification.

To Use.—The air vent plug is removed when the filter is in action so that the air circulates freely in the filter frame and allows the filtered water to come in and go out of the frame with ease.

The "Mussuck" filter should be cleansed once a month, and more frequently if the water is very bad.

To clean it, untie the leather thongs, pull the filtering frame out, dash water on the surface of the asbestos cloth, rub off the old charcoal with the hand, or with a soft brush, and after having rinsed out the "Mussuck" itself, replace the frame as before.

Fig. 2 represents a section of Maignen's Patent "Bucket Filtre Rapide" in actual working order. The two pails shown in use in

FIG. 2.

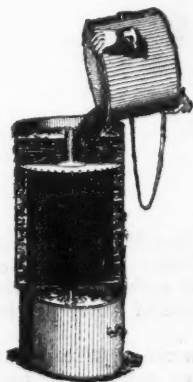


FIG. 3.

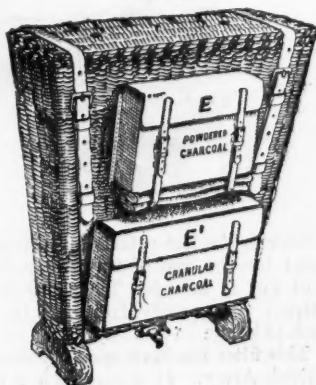


Fig. 2 fit over each end of the filter and are fastened together by a leather strap, which can be used as a handle. For further protection and convenience of carriage, these filters are provided with a strong wicker basket, which measures 16 inches by 12 inches by 12 inches. The weight of the filter without the basket is only 16 lbs.

Fig. 3 represents Maignen's patent "Field Hospital Filtre Rapide." This pattern has now been in use in Egypt for more than three years, the first order having been given on the 26th September, 1882, and has given such universal satisfaction as to induce the authorities to declare other filters previously used in field hospitals obsolete and to be dealt with accordingly.

Granular carbo-calcis is used in this filter in addition to the powdered, and the cleansing operation is performed only once a month. The pouch (E) in Fig. 3 contains eight charges of powdered carbo-calcis, and (E') part of a charge of granular carbo-calcis. Two canvas buckets are folded and held by leather straps between the two pouches.

The measurement of Maignen's patent "Field Hospital Filtre Rapide" is as follows:—The total height of the basket is 2 feet $3\frac{1}{2}$ inches; the width at the top is 1 foot $11\frac{1}{2}$ inches; and the width at the bottom is 1 foot $3\frac{1}{2}$ inches; the depth, including the pouches, is 9 inches.

FIG. 4.

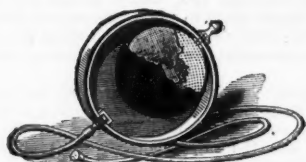


This is the last pattern of filters sealed by Her Majesty's Government for the use of the Army, September, 1886. Each water-cart sent out is intended in future to be provided with a pair of these filters; they purify from ten to twenty gallons of water per hour each (Fig. 4).

This filter has been specially designed for the use of Officers in the British Army. It is carried in a tin case, which measures $3\frac{1}{2}$ inches

by 2 inches by $3\frac{1}{2}$ inches, and which can be used as a drinking cup (Fig. 5).

FIG. 5.



The net weight of the "Watch Filtre Rapide" is 8 oz. The weight of one tin of carbo-calcis (for twenty charges) is 4 oz. The gross weight (including cup, and packed for post) is 1 lb. 5 oz.

Mr. P. A. MAIGNEN: The natives of India from time immemorial have used the chatties above referred to, and by utilizing them we save an enormous amount of money which otherwise would be required in order to send out filters to that country, of which the natives themselves might not approve, as they are very conservative and wedded to old habits and customs. The filtering frames which we supply are to go into the chatties and the mussucks.

Captain BURGESS: What does this attachment for the Indian mussuck cost?

Mr. MAIGNEN: Not more than 17s. for filtering from 5 to 10 gallons an hour.

Captain BURGESS: How long will it last?

Mr. MAIGNEN: The cloth will last ten or twenty years; nothing wears out but the charcoal, which they make themselves. Dr. Bartlett having compared this charcoal with such germs of disease as they have access to, has found that the particles of the charcoal are smaller than these germs or microbes, so that if the charcoal does not pass the microbes will not pass. The asbestos once saturated with the powdered charcoal is an absolute clarifier; all that is required to cleanse the asbestos cloth is to dash water on to it. The best claim that our invention has to your attention is that it has been used by the British Army of the Nile Expedition. Eight hundred of the "bucket" filters shown here were sent up with the boats, and the Camel Corps had one hundred each. These bucket filters have also been sent out by the India Office to India. They consist of a filter and two pails fitting over it, which are used one for holding the unfiltered water, and the other to receive the filtered water. Six weeks of supply of charcoal was carried in a box inside the filters. This charcoal can be used for treating wounds, or for any of the other purposes for which vegetable charcoal can be utilized. We have also here the Regulation "Field Hospital" filter to carry on mules' pack-saddles, and a "water-cart" filter, which is to be supplied to the two army corps which are being formed. To see the use of this water-cart filter I accompanied the volunteers to Eastbourne at Easter, and had the pleasure to see that it was highly appreciated both by Officers and men. It was running at the rate of 10 gallons an hour, and the very idea of having filtered water made the soldiers go a long way to get it. We know how difficult it is to make Tommy Atkins go out of his way, but let him once believe that there is a danger in drinking whatever water he meets with, and he will go a long way to get it pure. I have here a model of a filter on wheels for purifying large quantities. The actual size is about 4 feet 6 inches long, and it has 200 square feet of filtering surface, and is capable of filtering 500 gallons an hour. Of course I cannot show you the removal of microbes; it will be sufficient to say that if an impurity in solution can be removed, that which has a body, however small, is certain to be removed. I have been asked to give a reason why this particular system of filtration removes matters in solution whilst all the books say that filters only remove matters in suspension. It is like many other things we cannot exactly explain, we can only show the results; but the nearest approach to

an explanation which has found credence is this. The extreme porosity of the fine charcoal and its extremely minute size seems to be apt to condense oxygen; that is to say the little pore of the charcoal seems to say to the oxygen in the water, "You oxygen come and I will condense you," and as it were with that on the tip of its tongue this condensed oxygen seems to say to the organic matter (that is capable of oxidation), "You organic matter I burn;" to the metal in solution, "You metal I like; we combine, form an oxide; we become insoluble; we then have a body we cannot pass."

After some experiments showing the removal of lead and urea from water, Mr. Maignen said at the present moment the whole question of providing pure water for the soldiers is under the consideration of the War Office; the principle aimed at of course is to filter the water wholesale, and to distribute filtered water to the Army as you distribute bread or powder. But there are certain places and circumstances in which large bodies of water cannot be carried, and in that case recourse must be had to the water-bottle. The soldier objects and the authorities also to having an additional article to carry, and we are told that the soldier, if he has a pocket filter, finds it cumbersome, and throws it away. I have here an English and a Russian water-bottle, and we can sometimes learn something from our neighbours. The English water-bottle has a pewter screw, which is rather inconvenient; it is heavy, and not the cheapest thing to use. The Russian plug is of wood, and presents no objections. It has occurred to me to put one of my filter frames inside the bottle, so that you may drink the filtered water through the ordinary aperture. That will cost less than a shilling. The filter frame can be removed from the water-bottle, and used separately as a filter when drinking from a ditch. I have also another model, which has received the approbation of the War Office, and which has been selected by His Royal Highness the Duke of Connaught for his own use in India. Being made of enamelled iron, it is not liable to damage, and is easily carried.

The CHAIRMAN: Mr. Maignen will be happy to remain and continue the experiments, and give any further explanation to anybody present who takes an interest in the question, and I would venture to ask your leave to give him our warmest thanks for having shown us these interesting experiments.

OUR AMMUNITION COLUMNS.

By Captain G. HARRIS, Quartermaster, Ordnance Store Department.

It is understood that a real and solid effort is now being made to put two army corps into a fit condition to take the field. All the fighting parts of the force are forthcoming, and the necessary reserves for them duly appointed, it is presumed.

The Commissariat and Transport Service has doubled its cadres, and a heavy expenditure of money in horseflesh would no doubt put it on a war footing speedily.

The Medical Department and its rather numerous wants appear to be provided for in a general way.

The principle in each of the foregoing branches is to expand itself to meet the necessary requirements in time of war, and for which all the years of peace are quietly devoted.

The Staff of the Ordnance Store Department—the most important branch of all the supply departments, *i.e.*, the one charged with the duty of providing, receiving, holding, issuing, and accounting for all munitions of war and equipment—makes no visible preparation, but seems to be compelled by circumstances uncontrollable by it, to sit still and allow its uncompleted functions to be arranged for and carried out by other branches of the Service, more particularly so when it becomes necessary to arrange for the provision of ammunition columns for an army in the field.

The formation of these columns seems to be treated in quite an exceptional manner, consequent, it is assumed, on the necessity that they should be disciplined and able to keep up with the bodies of troops to which they would be attached.

The present method is as follows:—

On the army corps being mobilized, a sufficient number of batteries of field artillery would be broken up and converted into ammunition columns.

To one unacquainted with military matters, and to the heavy calls which are made on the reserves of an army (even though the fighting may not be heavy), the above plan would seem to be perfect; at once you have the Officers, men, and horses, and, on the equipment, &c., being supplied, they would be ready to take the field without delay.

But can we really afford to break up this splendid fighting force to carry out supply work?

Let us see what would actually occur on a mobilization being ordered.

Picture to yourself the striving, by all influence possible, of the various battery commanders to avoid having their batteries selected for breaking up, and how strenuous would be the efforts to leave the columns thus formed in order to get into the Service batteries.

Many of the best Officers would be successful in their efforts, and one can well understand that numbers of the best non-commissioned officers and men, and also (a most important item) many of the most serviceable horses, would be found transferred to the Service batteries.

These skeletons of their former selves would then be filled up with men from the reserves, and with fresh Officers, non-commissioned officers, and men from other batteries similarly treated; thus, with strange equipment and horses, and with all the well-understood absence of "pull together," the columns would be expected to stand the strain of embarkation, a sea journey, a landing, and probable immediate service in the field, and in a strange climate.

Only those who know the anxiety which falls upon the commander of a battery in the field when about to land with his complicated equipment, can judge thoroughly of the predicament the ammunition column commander would be in at such a time, with his long train of 51 vehicles and 257 horses, which latter fact alone might necessitate his command being spread over two transports.

Moreover, first consider that for years you educate Officers and men to certain work, and they become proficient in and proud of their duties—they are attached to their guns, and take a soldier's pleasure in their horses and their battery.

Suddenly the war clouds loom low, and you disintegrate battery after battery, take away their guns, issue out to them wagons, &c., and convert a fighting machine into what Officers and men will think (although as good soldiers they will not say), viz., that they are now hewers of wood and drawers of water, almost, for their brethren in the fighting line.

Imagine, say the Buffs, on the eve of a war, being told off as ammunition carriers for the other arms, and you can guess that cheerfulness would not reign supreme in the camp of that regiment.

Sooner than not proceed on field service, we know that Officers and men will gladly go in any capacity almost, and good soldiers will always do as they are ordered; consequently, any objection it might be urged to being in a battery converted into ammunition columns, is merely one of sentiment.

Well, good soldiers do as they are ordered; but if it can be pointed out how breaking up the battery can be avoided, and that to do so for the purpose of providing ammunition columns is a great waste of fighting material (which might at any later period be urgently required), then it is hoped that attention will be secured, for practical and not sentimental reasons in these proposals, and that it will be admitted that an effort is made to show how to provide equally mobile and more suitable columns without depriving the Royal Artillery of

a single gun, or effective Officer, man, or horse, each and all of whom would be required for its own legitimate field of action in the case of this country becoming involved in what we might call a "Two Army Corps War;" and in addition the nation would press for the formation at home of a third corps, or the visible materials for its composition, especially in the case of a check at the commencement of operations.

Prior to pointing out how the new columns may be provided, let us see what is the authorized strength of the several columns for two army corps.

A divisional column consists of—

- 4 Officers,
- 35 non-com. officers, artificers, &c.,
- 50 gunners,
- 123 drivers,
- 15 vehicles special to R.A., such as gun-carriages, &c.,
- 36 do. general to the Army,
- 21 riding horses,
- 236 draught do.

(Medical officer and vet. surgeon and their horses not included.)

There are three such divisional reserves for each army corps, and for the two army corps we must multiply the foregoing by six; this gives us—

- 24 Officers,
- 210 non-com. officers, artificers, &c.,
- 300 gunners,
- 738 drivers,
- 90 vehicles special to R.A.,
- 216 do. general to the Army
- 126 riding horses,
- 1,416 draught do.

We now pass to the army corps reserves.

The strength of one section is given as follows :—

- 4 Officers,
- 35 non-com. officers, artificers, &c.,
- 50 gunners,
- 80 drivers,
- 3 vehicles special to R.A.,
- 30 do. general to the Army,
- 21 riding horses,
- 148 draught do.

To two army corps there would be six sections, three to each; this would come to—

- 24 Officers,
- 210 non-com. officers, artificers, &c.,
- 300 gunners,
- 480 drivers,

18 vehicles special to R.A.
 180 do. general to the Army,
 126 riding horses,
 900 draught do.

The grand total to be provided by the Royal Artillery for this supply work from broken-up batteries, &c., being—

48 Officers,
 420 non-com. officers, artificers, &c.,
 600 gunners,
 1,218 drivers,
 108 vehicles special to R.A.,
 396 do. general to the Army,
 252 riding horses,
 2,316 draught do.

It will be seen that the total to be met is "a pretty tall one," to use an American phrase, but let us take it for granted that the Officers, vehicles (a store supply matter), and riding horses will be readily forthcoming, and set ourselves to the task of ascertaining from whence the—

1,020 non-com. officers, gunners, artificers, &c.,
 1,218 drivers,
 2,316 draught horses,

are to be procured.

Let any Royal Artillery Officer ask himself from whence he is going to produce this requirement for supply purposes alone, and how many guns of the batteries outside those selected for the two army corps, will have to go into store to enable the regiment to meet such a call; even if he makes a liberal allowance for the men coming up from the Reserves, as far as drivers are concerned.

As a first step, it will be necessary to show the number of batteries of horse and field artillery available, outside the Service batteries for the two army corps, and also their strength in non-commissioned officers, gunners, drivers, and draught horses.

On reference to the current Army List it will be seen that there are at home—

10 service horse batteries,
 39 do. field do.

The two army corps would appropriate of these—

6 horse batteries,
 24 field do.

leaving 4 horse and 15 field batteries to provide the drivers, draught horses, &c., for the ammunition columns.

Putting aside the 4-horse batteries, we find in the remaining field batteries the following strength per battery:—

79 non-com. officers, gunners, &c.,
 55 drivers,
 46 draught horses.

This for the fifteen batteries would give an available total of—

1,185 non-com. officers, gunners, &c.,
 825 drivers,
 690 draught horses.

It will be seen that this would not meet the case as far as the drivers and draught horses are concerned, *and that it would wipe out our remaining field artillery entirely.*

However, it is believed that if even it appropriated but one-half of the available force, public opinion and the best interests of the country would declare decidedly against the breaking up of this fighting force for purely supply purposes, and the apathy with which such intentions are now received will be no criterion of the storm of protest which would be raised with a big war imminent.

Such a result, leaving but a few batteries of horse and field artillery in England to meet casualties (heavy or light) in the field, would not be tolerated now that the nation takes an intelligent interest in such matters, and at the last moment, and at a very heavy cost, other means than those contemplated would have to be improvised.

Of course it may be said, "But batteries would be brought from India?"

To such it may be answered, that no man who looks ahead can count upon that for a certainty, and he who counts upon success, counts upon certainties only.

War is a game of chance more or less, but sensible nations leave as little as possible to chance.

Finally, no great assistance towards ammunition columns could be looked for from the garrison artillery, when it is considered what heavy calls would be made upon this branch of the Royal Artillery for garrisoning our enormous foreign fortresses, coaling stations, siege-train requirements, &c., not to speak of the home ports.

In addition, is there not something passing strange in the proposed arrangements to provide ammunition columns for the supply of the Army from the Royal Artillery?

You have one branch of the Army which provides the soldier with all descriptions of food, and which hands it to him wherever he may be; another branch is charged with care for his health, and attends to him wherever he is, in or out of the fighting line; a third branch of the supply services is trusted to provide shot and shell and other ammunition, &c., of all kinds for army use, to convey it across sea and land it, forward it to the advanced dépôt, and then all further trust in the capabilities of the Officers of the department seems to collapse, as far as the supply of ammunition is concerned.

It may send its Officers and conductors forward of the dépôt with unlimited arms and equipment if necessary, but not a single round of ammunition.

Up to the advanced dépôt we behave as a practical nation ; beyond that our system becomes "mixed," and the chain of responsibility broken.

The branch to which reference is made is that known as the "Ordnance Store Department," or which might be more properly designated as the "Ordnance Staff."

The Officers of this department and the corps represent at present a compact body of—

104 officers (readily increased),
80 conductors (readily increased),
680 non-com. officers and men,

with probably a reserve of 300 non-commissioned officers and men, making a total of nearly 1,200 Officers and men inured to all the complicated work of supply, and they are trusted to provide any one of the ten thousand other items to the troops in the fighting line such as I have already mentioned, but not a single round of ammunition beyond the advanced dépôt ; consequently, at a most critical point, there comes a break in the chain of supply, another branch of the Service steps in, and all the cumbrous machinery of handing over and receiving, passing vouchers, &c., commences, an entire and quit unnecessary change of responsibility takes place, and, to add to the strangeness of the proceeding, you break up numerous fighting batteries to carry this out.

The proposed columns would always find room on board one ship, and there would be no divided charge, and, in most instances, two columns could be accommodated in one vessel.

The Officers and men would be simply carrying out the work which fell to them during times of peace, and which they naturally consider their own in time of war.

The transfer of these duties in war-time to another branch leads to uncomfortable inferences.

Remember also that there will be an ever-present danger that when great losses come upon the service batteries (and come they will), there will be an irresistible desire on the part of the commanders of artillery to close upon men and horses from the ammunition columns to make good the losses in the batteries.

If these columns belonged to a distinct and separate corps this expedient would not even suggest itself, and some better method than that at present existing would be an absolute necessity, to enable the service batteries to recoup their losses in the field.

Let the commanders of artillery not forget that on the day that they meet the artillery of an European army, they must be prepared to give and to get such a pounding as all our former artillery contests can furnish but a poor idea of, and that they will be fortunate to be on the winning side if even with heavy losses.

Our artillery is as fine a force as can be produced on the Continent, and unsurpassable in discipline and efficiency ; but it must not be forgotten that, according to the old adage, "accidents occasionally happen

in the best regulated families," and it well becomes the authorities as able children of men, and wise in their own generation, to consider further any alternative scheme prior to breaking up a single fighting battery for purely supply work.

If ever we become involved in this "Two Army Corps War," we may depend upon it that every effective man and gun will be required sooner or later; and whether we be fortunate to be on the winning side, and gain instead of losing ground, the Officers commanding the artillery will be sufficiently employed in their own special province, without being called upon to superintend supply services.

The Adjutant-General of an army in the field and his deputies who are charged by the Regulations with the disposition of all these supplies of ammunition, can surely carry out their duties without straining the resources of the artillery.

The Adjutant-General's department is a numerous one in the field—its staff command at the front—on the lines of communication, and at the reserves, and this splendid body of Officers should experience no difficulty in seeing that the Ordnance department had every round of ammunition on the correct spot.

No new posts or appointments would be necessary in the proposed arrangements.

Possessing as we do this large Ordnance Staff of Officers, non-commissioned officers, and men, disciplined and well acquainted with war material of all descriptions, let me ask where you can get a better or more suitable establishment for the work—serving as they do in all parts of the globe—constantly engaged in all the intricacies of supply duties, contriving in all our small wars to get on without any specially constituted ammunition columns other than its own, and keeping the Army well supplied with ammunition and stores; why seek for an organization outside it?

This corps of Officers and men is a splendid nucleus for ammunition columns up to any strength, and no objection can be urged that it is unsuited to assume supply duties in the field as regards ammunition on the score of want of knowledge or ability.

Increased facilities and an extended organization are given to the Transport branch to bring it up to its war requirements. Permission is given to the medical staff to search the ranks of the militia and volunteers for aid to bring that department up to its war strength.

Why not give this large staff of the Ordnance Store department similar facilities, put it upon its mettle, look to it to point the way for due provision being made for the supply of ammunition (as well as other stores) to the fighting line, and not stop short at the advanced depôts?

Why break up a single battery if it can be avoided?

Why employ a single effective fighter unnecessarily in the work of supply?

Why not provide the necessary horse-flesh for this duty quietly in time of peace, and almost inexpensively if the proposals to be given hereafter be followed, and thus be clear of the high prices for inferior horses which would prevail when war became imminent?

An effort to answer these problems is considered quite sufficient justification for this paper, and we will address ourselves to an endeavour to solve them.

Of the 980 non-commissioned officers and men with the colours, and in the reserve belonging to the Ordnance Corps, 100 would be employed on various Colonial stations; 250 would be necessary for the ordinary work of the department in the field. This would leave upwards of 600 non-commissioned officers and men, which would be ample for the proposed columns for duty as issuers, &c. (*i.e.*, the same duties as would be performed by the non-commissioned officers and gunners now employed with the columns). They would be men able to read and write, and be thoroughly instructed and understand the main principles of supply work.

The duties at home of the Officers proceeding on field service could be done by Officers on the Retired List, and that of the non-commissioned officers and men by pensioners.

It has now been shown how the Officers to command, the subordinates to issue out, load up, unload, and guard the columns, would be provided.

We will now pass to the present and proposed vehicles, leaving the most important items, the large staff of drivers and draught horses, to the last.

The vehicles at present laid down for the ammunition columns of two army corps are as follows, viz. :—

- 12 16-pr. spare gun carriages and their limbers (packed), each drawn by 4 horses with 2 drivers.
- 12 9-pr. do. do.
- 36 16-pr. ammunition wagons with limbers (packed), and drawn each by 6 horses with 3 drivers.
- 36 9-pr. do. do.
- 12 Forge limber wagons with limbers, each drawn by 4 horses with 2 drivers.
- (The foregoing are special to the artillery.)
- 144 S.A.A. carts drawn by 2 horses each, with 1 driver.
- 216 General service ammunition and store wagons drawn by 6 horses each, with 3 drivers.
- 24 Do. do. drawn by 4 horses each, with 2 drivers.
- 36 Do. do. for stores, baggage, rockets, and spare purposes, drawn by 6 and 4 horses each as required, with a corresponding number of drivers.

(These carts and wagons are more or less general to the Army.)

In the proposed organization it is suggested that the

- 12 16-pr. spare gun carriages,
- 12 9-pr. do. do.
- 36 16-pr. do. ammunition wagons,
- 36 9-pr. do. do.
- 12 Forge (limber up) wagons (these latter might be reduced to 6)

be removed from the ammunition columns and accompany the corps artillery as an artillery reserve for carriages, drivers, horses, &c., and thus enable the guns to rapidly replace losses without interfering with the regular work of supply.

If this were not found convenient or suitable at all times, they could be attached to the ammunition columns (under a Royal Artillery Officer), and would be expended under the orders of the Officer commanding Royal Artillery as above indicated.

It now remains to provide for the conveyance of the—

144	S.A.A. carts,		
84	G.S. wagons,	drawn by 6 horses,	
168	do.	do.	4 do.

S.A.A. Cart.—This cart is drawn by two horses (the driver riding one), and the cart's construction and also the draught is considered open to great improvement.

The S.A. ammunition itself is first packed in packages of ten rounds in brown paper, about sixty of these are placed in a tin-lined (hermetically-sealed) box made of strong mahogany or deal nearly an inch thick, and finally bound with copper straps—strong and sure enough in all reason to stand years of knocking about on field service—one would think that if the boxes were covered with a tarpaulin or greased sail cover, and packed neatly in an open cart which could be used for other purposes at some other stage of its existence, all that was required had been met, considering that the danger of explosion is practically “nil.”

On the contrary, a cart is provided with a number of wooden compartments, with a sloping roof, and closed up at the back; it will carry a certain number of boxes and no more, however great the necessity, and the graceful slope of the roof prevents one even placing a ration of forage or a wounded man on it at a pinch.

Again, ten chances to one if after the issue of a box of ammunition is made, all balance on the part of the cart is destroyed, and cannot be readily perceived and re-arranged.

An open cart with sides would enable a greater quantity of ammunition to be conveyed, and the driver could sit on the front of the cart—the necessity of having drivers able to ride would be avoided—a horse of from 5 to 10 years old would readily draw this, from 20 to 25 miles a day, taking roads as you find them; would also be able to move considerable distances at a trot, and would get the load across country in a way that would put the present driver (with his two service horses) to the blush.

A sail cloth to cover the ammunition, and when halted, sufficiently large to come over the sides and ends and reach the ground, would provide sleeping accommodation for the driver and issuer attached to it, and also cover for the harness in inclement weather.

No tents would be necessary for these men.

A cart of this description could be used for other purposes in military life, would be useful in civil life, and on the conclusion of a

war would be worth transit home for sale; lastly, instead of 144 carts 132 would be found sufficient.

Each cart could carry a small supply of entrenching tools, and would never have any difficulty in keeping up with troops, thus saving the soldier's spinal column, which inventors of entrenching tools, &c., seem to be under the impression was specially fitted up as a peg for hanging their inventions upon.

Ammunition and Store Wagons, General Service, &c.

With regard to this wagon and its stiff tall sides and low canvas roof supported by bale hoops, who ever saw a G.S. wagon survive the ordeal of shipping and unshipping, and be found with bale hoops and their staples safe and sound and the canvas cover untrorn?

Then, again, the struggle to get at boxes in the underneath layer in the centre, for instance, and the delay to arrive at a fair idea of the wagon's contents, moreover, everything must be loaded and unloaded at the rear end of the wagon, for if the cover did not prevent it the sides would not long stand the heavy pounding of boxes being roughly placed on them, and the height to lift the box is great.

If it were necessary for the columns to pass through streets or villages in a state of conflagration, the present canvas covers would seem to be the readiest way to court the danger they are intended to shun. Why not clear away the bale hoops and have only a greased sail cover (which could be readily saturated on the upper side with water on an emergency).

Gun cartridges and shell can now be so securely packed in their respective metal-lined cases and boxes that very little additional precaution is necessary, and in fact the ability to readily throw off a sail cover and inspect the contents of each wagon is a desideratum not to be over-estimated.

The cover could be thrown over the wagon at night, the ends falling to the ground, and underneath the wagon would be plenty of space for drivers and issuers attached to it to sleep.

Tents would again be unnecessary, and during inclement weather the wagon and its cover is infinitely superior to a tent.

This wagon is at present drawn by six horses with three drivers, a great waste of material and power, it weighs $19\frac{1}{2}$ cwt. and its load is 30 cwt. about.

It is suggested that after the present stock may be used up, these wagons be constructed to approach more closely to the wagons carrying similar weights in use by the great carrying companies and corporations (the wheels and axletrees could remain interchangeable, the body and pole or shafts only requiring alteration). It could be driven from a box seat and drawn by two horses of a stronger build than the present Royal Artillery draught horse, say from 5 to 10 or 12 years old. There would again be no necessity for rejecting a competent driver because he could not ride.

The ordinary army ration of forage would be quite enough for

these horses, and the class of driver proposed might be depended upon to see that none was wasted.

With reference to the stowage of the ammunition it is as well to point out the present great waste of space, and the enormous amount of additional material unnecessarily carried.

Take a box of 16-pr. common or shrapnel shells—these are studded projectiles—and on opening the box it will be found that each shell is carefully kept from touching its fellow, the idea being to keep the soft metal studs from injury.

If a trial be made it will be found that there is no difficulty in placing eight shells in this box instead of six, and yet carefully protect the studs, and in addition the size of the box can then be reduced.

The same remarks apply to the boxes containing 9-pr. ammunition, when a saving of stowage of about 30 per cent. could be made.

With regard to the studless 13-pr. projectiles which require protection in travelling for the copper gas-check only, it will be found that a saving of space on the present packing of nearly 50 per cent. can be made.

These are considerations of transcendent importance.

G.S. wagons for use as forge wagons can be fitted up with the useful and efficient forge and set of tools now carried by the "forge limber-up wagon," and could be horsed and driven as the other wagons.

One forge wagon would accompany each column, and would be available for the service generally of the Army; it would also be able to convey a good supply of horse-shoes of a pattern suitable to these horses.

Breaks should be fitted to the rear of each of these wagons; this could be attended to by the man acting as issuer, and if in future patterns the wagons could be assimilated to those in use in mercantile life they would be worth transit home, and would sell readily if necessary.

These remarks apply with equal force to all the wagons in use in the Transport service.

Drivers and Horses.

We now pass to the provision of the drivers, horses, harness (and vehicles when the present stock is exhausted).

In the columns proposed, 480 drivers would only be required instead of 1,218, and as the men will not need to be able to ride, you may count as on a certainty, that larger numbers of suitable men from which to pick will be available.

In this country we have in all our large and small towns Corporations whose show of horseflesh and capable drivers is something unique, and they are now-a-days closely followed in this respect by the various agencies of the large carrying companies and contractors for great engineering works, &c., &c.

The horses are always kept in splendid condition, and the stables and

interior economy of these establishments of horses and wagons are surprisingly good.

The result of enquiries assures me that if these Corporations, &c., be approached in a proper sense, both from a patriotic and also a business point of view, a ready response to a Government Circular (as below) would be the result.

Circular.

To the Corporation of .

Your total number of horses, wagons, carts, and drivers at present in employment is—

60 drivers,
80 horses,
40 carts,
30 wagons.

Would you be prepared to provide in case of war, and during peace time for twenty-one days annually (for manœuvres)—

6 drivers,
10 horses with harness,
2 carts,
4 wagons?

On the conditions following:—

The drivers to be *bonâ fide* Army Reserve men in your employ and recommended by you, and for each man so entering the Army Reserve up to the above number, your corporation to receive 2*l*.

The Government to pay you 5*l*. per annum for each of the above horses held ready for Government use as above stated.

Half the price of the harness which would be in good order on the horses being called up.

Half the price of each wagon or cart if they be of the authorized pattern.

All the foregoing to be passed by a Government Officer.

The wagon to be guaranteed by the Corporation for eight years and the cart for ten years.

Casualties in war time to be replaced at the Government expense.

Re-employment for the drivers to be guaranteed by the Corporation on the termination of the war, provided the drivers return with good characters.

The men would be retained with their own horses as long as the exigencies of field service would permit.

The following reasons would stimulate the several Corporations to view these proposals favourably:—

1. The small call made upon each Corporation would not cause it inconvenience to replace.

2. The patriotism of each individual member and his constituents would be brought into play.

3. The fact that this method would solve an otherwise expensive problem and ease the taxpayer.

4. In time of peace the use of the wagons, &c., for twenty-one days or less would be unfelt.

5. That a payment in part was being made would also soothe the business keenness of the several towns, &c.

6. The certainty that a good many years would intervene between our "Two Army Corps Wars," and thus casualties on field service would be the exception rather than the rule.

A prior warning would (if possible) be always given to enable the horses to be hardened by outside stabling, &c.

The proposed details are as follows:—

	With 1 column.	With 12 columns.	Remarks.
<i>Officers.</i>			
Major (or A.C. General)	always with column in front	6	Administrative.
Captains (or D.A.C. General)	1	12	In command.
Lieutenant (Quartermaster)	1	12	Assisting do., and as accountant for am- munition.
<i>Warrant Officers.</i>			
Conductors of stores.	2	24	1 for discipline, 1 for office work, pay, clothing, &c.
<i>Non-com. Officers and Men.</i>			
Staff sergeants or sergeants	4	48	
Rank and file, non-com. officers	8	96	
Privates as issuers, clerks, and ser- vants	40	480	
Drivers (and as grooms)	40	480	
Buglers	2	24	
<i>Artificers.</i>			
Sergeant farrier	1	12	Large numbers of the men of the O.S. Corps are trades- men, and would be also available.
Shoeing smiths	3	36	
Carriage smiths	1	12	
Fitters	1	12	
Collar makers	2	24	
Wheelers	1	12	
<i>Vehicles.</i>			
S.A.A. carts	11	132	
Ammunition and store wagons	20	240	
Do. do. as a forge wagon..	1	12	

	With 1 column.	With 12 columns.	Remarks.
<i>Horses.</i>			
Riding horses for Officers, warrant officers, sergeants, buglers, half the rank and file, non-com. officers, artificers, and 2 spare	20	240	
<i>Draught Horses.</i>			
1 per cart, 11 } 2 „ wagon, 42 } 4 spare, 4 }	57	684	

It will now be seen that instead of taking away from the Royal Artillery

420 non-com. officers,
600 gunners,

we should have the work of issuing, &c., done by the present Ordnance Store Corps and its reserve (their duties at home being performed by pensioners), and instead of depriving the Royal Artillery of

1,218 drivers,
2,316 draught horses,

we should have this supply work done by

480 drivers,
684 draught horses.

The difference in the lengths of each and all of the columns, and the lesser number of mouths to be fed, is an important consideration.

The proposed method of driving is practically what the Transport Department of the Army will have to come to, fight they ever so much to retain the imitation of artillery gun teams.

In addition this change in driving and the consequent less exhaustion of the horses, the clearing away of all unnecessary top hamper, reduction in the number of shell boxes consequent on the change in their packing, the provision of heavier and stronger horses all inured to draught, would enable the numbers of wagons and carts to be reduced as under, viz., instead of—

84 wagons drawn by 6 horses, with 3 drivers,					
168 do. do.	4	do.	2	do.	
144 carts do.	2	do.	1	do.	

we should have—

252 wagons drawn by 2 horses, with 1 driver,			
132 carts do.	1	do.	1 do.

a difference of—

12 wagons utilized as forges,
12 carts dispensed with altogether.

Each wagon would when packed weigh 55 cwts. (i.e., $19\frac{1}{2}$ cwts. for wagon, $35\frac{1}{2}$ cwts. for load), not too great a load for two powerful horses, and some cwts. less than they would always draw under their civil masters, taking roads as they found them, good and bad.

There would thus be a total of twelve columns, three columns in front and three in reserve with each army corps; and it is claimed for this similarity in strength, composition, and ammunition carried, that, should it be necessary for the General Commanding-in-Chief to order any of the columns from one division to pass over to the aid of other divisions to replenish expended ammunition, the Adjutant-General's Department would know what to arrange for at once, but, if any such necessity arose now, the transfer of the whole or a portion of the divisional column would bring with it confusion, for the corps reserve section could not replace it suitably, being composed of all wagons and but two carts.

The columns as proposed would be interchangeable throughout, and advantage could be taken of this whenever it would save a day's march on the part of any of the columns—thus for instance an army in position might have fought on its right flank and expended ammunition—two of its columns might have to march to the rear to replenish, these might move to roads on the unexposed flank, and intact reserve columns brought over from the corps on the unthreatened flank—the columns would thus carry out their duty with less confusion and risk, and on return would move into their new position as reserves for the divisions on the less exposed flank, and the Adjutant-General would know exactly how he stood—the knowledge that it was necessary for two columns to march to the rear to replenish would give him an idea clearer than scores of returns of expenditure.

There being no difference between the Divisional and Army Corps columns, the forward column would always be the divisional column, and the rearward one that known as the army corps reserve.

The twelve columns would start at first with the same quantities of S.A. and gun ammunition as those now authorized, and each column would, as its turn came, be able to deliver direct to the troops in the fighting line, without the additional cumbrous method involved under the present organization, which would seem to arrange for the actual transfer on the field of the contents of each section to the divisional reserve, and all the necessary formulæ of vouchers, &c., which would again occur, on the divisional reserve passing the ammunition to the troops engaged.

There could always be the same number of ammunition carts forward as there now are, if it were considered expedient, in order to facilitate a quick supply across a broken country for instance; and as the expenditure went on, a column emptied of its contents, either to the troops, or to a fellow column of its unexpended loads, could at once commence its march to the rear intact and complete, thus

avoiding the first elements of confusion always caused by splitting up troops.

There would never be the risk of any wagons at the front remaining empty until supplied by other wagons as at present, and the columns marching to the rear early in the day could rapidly clear the field hospitals of cases fit to travel by their wagons, and who could be put into them rapidly, in order that the rearward march of the column would not be impeded.

The composition of the columns as proposed would enable them to empty their loads and gain a march to the rear of quite half a day and similarly with the next column emptied, this of course meaning that they would be back again so much the sooner.

A gain of hours means something in these matters.

The division of the columns into twelve units will ensure the greatest quantity of ammunition being at the front, and if the expenditure should become heavy, the greatest number of vehicles would be on the road for further supplies, a consideration not to be discarded with the advent of a quicker firing rifle than the Martini-Henry.

The Divisional Commander would consider the column nearest to him and marching on his line as the divisional reserve, and the column next behind that, although nominally for the army corps, would be as at present his further reserve.

These arrangements would be readily understood and would ensure a fair share of hard work, hard marching, and conjoint responsibility for a perpetual supply on the part of the columns throughout.

Our present system seems to arrange for the supply to the troops being done by one half, and the marching to and from the advanced dépôt by the other half, hardly a fair division of labour.

Under the present arrangements large numbers of horses would have to be provided suddenly, and they would not stand the noise of the heavy firing. Under the proposed arrangements we should know where our particular horses were, and each horse could be treated to the expenditure of a couple of boxes of "doubtful ammunition" weekly, for an indefinite period, to accustom them to the din infernal, without trenching very heavily on our stock of that commodity.

The responsibility having clearly been placed on the Ordnance Store Department, it may safely be reckoned upon, now that the staff of the department has a large and intelligent corps of its own, to speedily supplement the supply line by all available local means, accustomed as the Officers are to serve in all quarters of the globe (except India), instead of having to sit still with folded arms, impotent to carry on the work they feel to be theirs only.

In the columns proposed, all the elements of discipline, knowledge, and soldierly instincts would be combined. Nothing would be wanting to ensure the continuous supply and responsibility from Woolwich Arsenal to the base of operations, and from the base to the fighting line.

The saving in years to come, on the manufacture of wagons and carts, &c., and the provision of the large personnel of the present columns, would alone suffice as a reason for giving these proposals a trial.

The boon to a General and his Staff Officers in reducing the miles of supply columns is beyond calculation, putting aside the crowning fact that, if some suggestions similar to those embodied in this paper be not undertaken, we shall see with the embarkation of two army corps the almost entire wiping out of the remaining field artillery.

No nation in its senses could permit such a proceeding, and neither can a practical people be expected to keep ammunition columns eating their heads off in time of peace; but if a *modus vivendi* can be found to obviate a heavy peace expenditure, whilst still providing with certainty the necessary columns when war draws nigh, it would be simple self-destruction to neglect it.

Moreover, it is now very evident that, until the ammunition columns point the way to the system proposed of horsing, driving, and construction of wagon, &c., we shall get no material changes in the present draught arrangements of our Army Transport.

The same persistent effort to follow the field guns in their methods (quite suitable for the guns) seems to go on as regards the transport service. Wagons with the least possible carrying capacity and the greatest expenditure of drivers and horseflesh, still form part of our Transport equipment, and are the greatest components of the baggage trains.

All can be improved with a certainty of gain to the country both in efficiency and cost.

This paper is written without the slightest intention to depreciate any of the services referred to, but with a heart-felt wish to aid in their improvement.

Practical experience has dictated many of the remarks.

The issues involved are important but simple.

Statement showing Cost of Proposals.

	£
For 684 horses at 5 <i>l.</i> per annum per horse	3,240
Honorarium to Corporations, &c., for 480 drivers recommended by them, at 2 <i>l.</i> per man every 6 or 8 years	960
For 252 wagons half cost every 8 years	} These charges would not fall due for years, there being a good stock in hand.
„ 132 carts do. do. 10 do.	
„ 684 single sets of harness every 6 years.....	
For Reserve pay of drivers. This would come from the ordinary Reserve pay vote.	
Charges during hostilities for home service:—	
50 Retired Officers at from 5 <i>s.</i> to 10 <i>s.</i> per diem in addition to their pension	} Daily £110
250 military or naval pensioners at 3 <i>s.</i> 6 <i>d.</i> per diem as clerks, and 400 at 2 <i>s.</i> 6 <i>d.</i> per diem as labourers	

The permanent charges to be considered are consequently that for horses, and for drivers' honorarium, viz., about 3,580*l.* annually.

Ad.

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Wednesday, June 15, 1887.

ADMIRAL THE RIGHT HON. SIR A. COOPER KEY, G.C.B., F.R.S.,
&c., &c., Vice-President, in the Chair.

BLOCKADES: UNDER EXISTING CONDITIONS OF
WARFARE.

By Rear-Admiral P. H. COLOMB (Gold Medallist R.U.S.I.).

HAD I recollected when I accepted the invitation of the Council to read this paper, that Captain Long had in 1881 read one here under the title of "The Study of the Tactics of Naval Blockade as affected by Modern Weapons," I think I should have asked permission to make some change in the present title, for the changes which have taken place in the conditions then and now are not such as to suggest any entirely new ground, and I do in fact only hope to approach Captain Long's subject from a possibly rather different point of view. Captain Long's paper should, however, be read with this, as checking and controlling it. Indeed the chief change of condition which we may note is perhaps some change of opinion since Captain Long wrote, not of a very solid or reasoned kind, and not founded, so far as I can see, on any definite data.

It may be well to point out in the first instance that the blockade of which I have to speak to-day is military blockade—the blockade of war ships. Otherwise it might be easily supposed that it would be proper to touch on the law of blockade and the intricate question of prize for breach of blockade. If we call the blockade of war ships military blockade, it would no doubt be convenient to call the other civil, or commercial blockade, for although it is a military operation it has behind it the sanction of law, whereas military blockade has only the sanction of force behind it.

And in considering the subject we shall at once see that whereas we ordinarily speak of military blockade as if it were but one thing, or but of one kind, it is really three things, or three kinds of the same thing. It will be clear to you that this is so when I mention the three words *Sealing-up*, *Masking*, and *Observation*. These words denote three quite different operations, and yet we know that they have at all times been carried out and spoken of under the same name. I will give you three familiar illustrations which will at once make the distinction clear. Nelson, in March, 1794, speaks of blockade in its first and special sense when he writes, "The blocking up of Corsica he (Lord Hood) left to me: it has been accomplished in the most com-

plete manner; not a boat got in or a single soldier landed, although 8,000 men were embarked at Nice." Here the object was more to prevent ingress than egress, but it would have been just the same had he claimed that not a boat or a man got out. The ports of Corsica were sealed up. The intention was that nothing floating should either leave or enter them; that was the ultimate object, and it was attained. When Nelson arrived near Cadiz in October, 1805, with his full force, he was so far from blockading the Franco-Spanish Fleet that he purposely kept his own ships out of view, in order if possible to deceive the enemy into a belief that his numbers were smaller than they actually were; but he kept close watch on Cadiz by an inshore squadron and repeating ships, so as to have the earliest intelligence of the enemy's movements. If the Franco-Spanish Fleet had not come out this would have been called blockade. Similar operations had often been conducted under that name; but it was evidently not the sort of blockade which the same Officer had carried out at Bastia. The object was the opposite of blockade. It was hoped that the enemy would come out, but every precaution was taken that if he came out he should be fought. The operation was not blockade; it was *masking*. So long as the English Fleet was there the Franco-Spanish Fleet was harmless. It could only become mischievous by fighting and beating the English force.

Before Nelson arrived off Cadiz the operation was called blockading; but it was not; nor was it masking. Collingwood took his station off the port with no more than four line-of-battle ships, well knowing that the Franco-Spanish Fleet might any day come out and surround him with thirty-five ships of the line. Collingwood, therefore, was neither *sealing-up* nor *masking*; he was *observing*. He had no power of keeping the enemy in port, nor of fighting them if they came out; but he had powers of watching them, and of reporting their movements. He exercised both. He despatched Blackwood home with news of their arrival; he remained watching himself; and had they come out he would have hung about them and detached ship after ship until he was left alone to report on their route and probable designs.

As there are, therefore, these three distinct operations included under the ordinary term blockade, it requires little reflection to see that we must consider them separately before we can come to any conclusions either on the general subject or on particular applications of it. I shall have to form and to express in this paper opinions as to how far "blockade" can be carried out "under existing conditions of warfare." These opinions are now freely expressed on both sides of the question. Great differences exist; but I am not sure that the disputants have commonly, or even at any time, drawn the distinctions that I have now done; and it may be found that some of the differences have arisen from the fact that opponents have in their minds different things, though they have both been using the word blockade. We may easily, I think, come to two apparently opposite conclusions, and yet not be open to the charge of inconsistency. "Blockade" may be pronounced impossible in modern warfare, and

yet "masking" and "observation"—commonly included under blockade—may be held quite possible.

A great number of naval Officers hold the opinion that it is worse than useless to go back to naval history for the lessons of modern naval war. I have been for many years past of a contrary opinion—an opinion which grows stronger every day—that it is impossible to form correct views of the present or future of naval warfare unless they are based on a pretty thorough investigation of its history in the past.

A Royal Commission appointed in 1859, nominally to consider the "defences of the United Kingdom," but really only to consider the fortification of the Royal Naval Ports, reported in 1860 that "it would be very unsafe to rely on the experience of former wars in judging of" the question of the power of our fleets to mask those of the enemy. No one certainly ought to "rely" on the experience of former naval wars under sail, to guide him in forecasting the future of those under steam, if to "rely" meant to expect the same thing under very different conditions. But this sentence was probably meant to go further, and to say that past experience was no help to the preparation for the future. It was followed up by the wide assertion that because of steam "the efficient blockade of an enemy's ports had become well-nigh impossible."

It was the more remarkable that such a thing should be said at that particular date, seeing that six years earlier we had established and maintained by means of steam vessels a most rigorous and absolute military blockade of all the ports in the Russian Empire for two years.

The very next year, too, was to witness the establishment of a blockade of the coast of South America from the Chesapeake to the Rio Grande. And so far from this gigantic operation of war being unsuccessful, it resulted in the destruction of 270 sailing vessels and of 85 steamers, as well as in the capture of 939 sailing vessels and 210 steamers. This steam blockade also was undertaken by a nation totally unprepared for it—a nation which had, when the war broke out, only about twenty-four war steamers all told in commission, of which the most part were on distant stations.¹

This operation was sealing-up pure and simple. The attempt was to prevent all egress and ingress from and to the enemy's ports—clearly the most difficult form of blockade. The Royal Commissioners were not thinking of this in their modified denial of its possibility. As they were showing that the naval defence of the United Kingdom was not to be depended upon, they must have included both masking and observing in their use of the word blockade. Blockade in their view had been rendered by steam well-nigh impossible, and so there was the broad chance that the enemy's fleets would evade the masking fleets off their ports and elude the watchfulness of the observing squadrons.

I believe I shall not be far wrong in assuming that another Royal Commission sitting now might, if it were to decline to examine and

¹ Soley: "The Blockade and the Cruisers."

draw the lesson from history, be tempted to say that the torpedo-boat had made blockade "well-nigh impossible." It may not be amiss to notice that hardly anyone would agree that steam alone had made sealing-up, masking, or observing more difficult than they had been in the days of sailing ships. It may quite be that the same change of opinion will follow longer acquaintance with the torpedo-boat.

But my point is that steam, looked at in the light of history, had at least not injured our powers of blockade in any of its three aspects. A contrary opinion could only be arrived at by taking into account all the advantages which steam gave to the enemy for escape from his ports, and neglecting all those which it had given to the blockading force for observing him.

Such a blockade as the Federal States set up off the Confederate ports could not have been thought of before the days of steam. It was steam which enabled the ships to close into the mouth of the port. It was steam which, by mitigating, if not removing, the perils of a lee shore, enabled the Federal ships to anchor as close to the water passage they were guarding, as the range of the enemy's guns planted on shore would allow.

There was not generally any real attempt at anything more than observing and masking during the revolutionary war, and only the inshore squadrons of frigates and light ships kept close off the ports containing the enemy's fleets. The dangers of a lee shore necessarily kept the blockading fleet with a good offing when the wind was foul for exit from the port; when it shifted and made a weather shore, it blew the blockading fleet off, and the blockaded fleet out.

When Hoche and Morard de Galles had brought the preparations of the Irish Expedition to a state of completeness in December, 1796, in the harbour of Brest, Colpoys, with (apparently) fifteen sail of the line, was masking them. In the language of Schomberg he was "cruizing off Brest" (Fig. 1).

The greater part of the troops were embarked as early as December 1st, and Wolfe Tone, whose journal gives a very fair picture of what was going on inside at Brest, embarked on board the "Indomptable" on that day. On the 3rd he could only say it was "pretty certain that the English were in force off Ushant to the number of sixteen ships of the line and ten frigates." Colpoys was generally so far off as not to be visible, but the mere idea of his vicinity was sufficient to delay the sailing of the squadron. The watch was so loose that Richery with five sail of the line and two frigates got into Brest from Rochefort on the 11th December, and this movement followed on the return to England of Sir R. Curtis' squadron which had been cruising near Belleisle between those two ports.

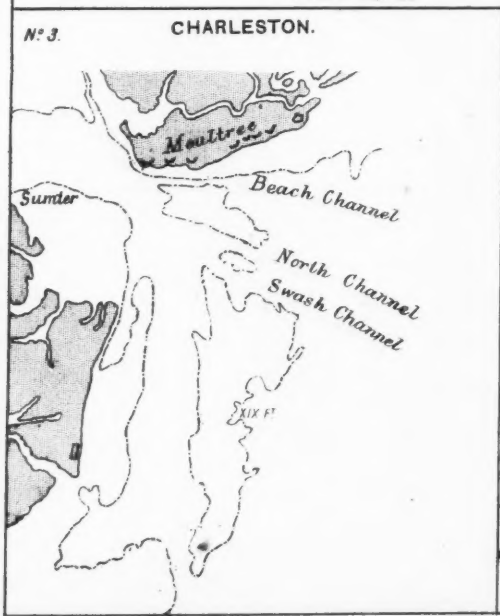
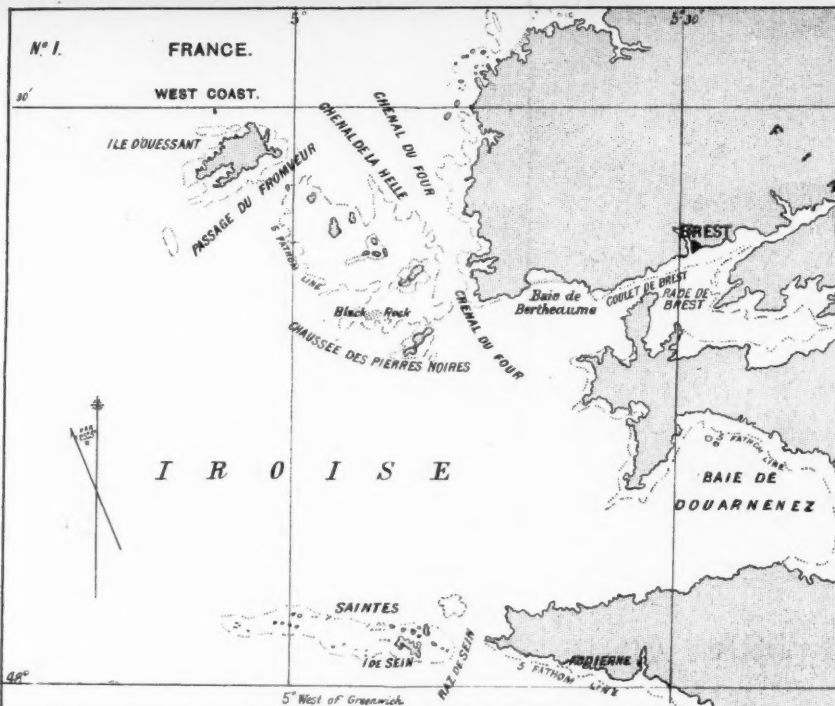
On the 15th December there had been for more than three weeks a fair wind out of Brest, and then they could only see from the lookout at the point, four sail of the enemy. These were Colpoys' frigates, but he himself had been blown 30 miles to the westward, so that the French Expedition was able to sail the next night. Colpoys, having thus missed them, returned to Spithead on the 31st.

What is the lesson of history here if we choose to read it? The

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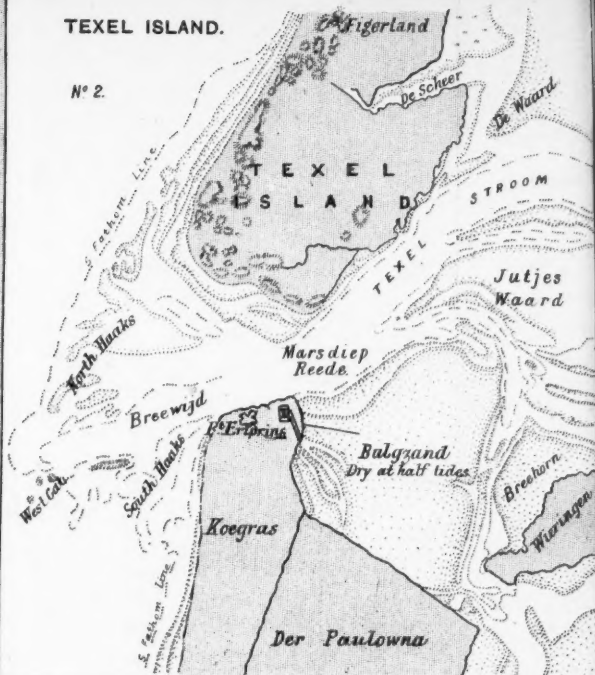
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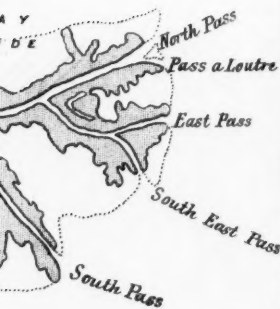


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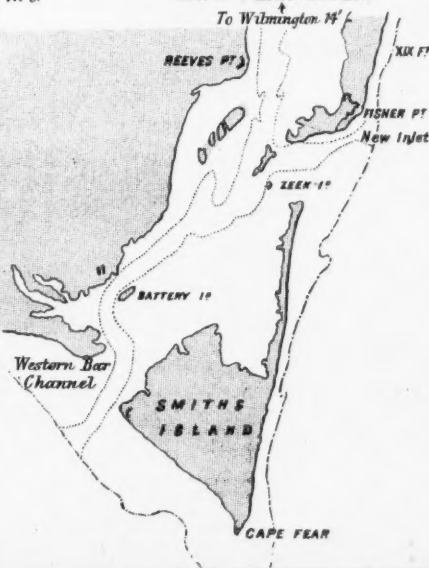


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To Wilmington. N° 6.



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fair wind out of Brest gave to the French all the advantages which steam could have put at their disposal; but it took away from the fleet of Colpoys all the advantages it gave to the squadron he was watching. If Colpoys had had a steam fleet he would never have been blown 30 miles away. He would have been seen every morning from the Brest signal station, and it is doubtful whether even the idea of the expedition could have matured under such circumstances. As it was, Richery very nearly ran into Colpoys' jaws on making for Brest. Had the former been able to maintain a position closer in, Richery would never have sailed from Rochefort.

I think this historical lesson is complete. The men are men whether the motive power be steam or wind. The French Expedition sailing in darkness through the Raz du Sein did everything that steam could have permitted. It was the absence of Colpoys which allowed of the escape. Had Colpoys been independent of wind, he would not have been absent. Hence steam is shown, by the experience of the past, to have made masking a certainty which it never was before.

We might easily misread another lesson, where the same Wolfe Tone tells us the best of the story. On the 8th of July, 1797, he arrived at the Texel and found De Winter's expedition ready to start; troops were on board, and everything complete. The force consisted of 15 sail of the line, 10 frigates and sloops, and 27 transports. The troops embarked came to about 13,500 men. Lying in the Texel it is apparent that they looked straight out to sea, but though Duncan's fleet was very usually in sight from the Dutch ships, it was not always so. Wolfe Tone on the 14th of July counted from the stern windows of the "Vryheid" "ten sail of English ships of war, little and big, who had presented themselves off the mouth of the Texel." On another occasion De Winter was dependent on the return of a flag of truce for the numbers and force of the enemy (Fig. 2).

On the 16th July, the Dutch Officers received their final instructions, and only waited for a fair wind to sail, in defiance apparently of Duncan's squadron. But the wind was "as foul as the devil." On the 20th the Dutch saw nineteen sail of British ships, but were assured that not more than twelve of them were of the line. De Winter was in fact well aware of every movement of our Navy, and the distribution of our ships. Yet the nearest wind to the N.E. wanted, was N.W. "Damn it to all eternity for me!" writes Wolfe Tone. On the 20th, Tone had been eighteen days on board, and they "had not had eighteen minutes of fair wind." On 27th and 28th there was a fair wind, but so light that the Dutch could not stir. They could then see Duncan at anchor and counted twenty-two sail. De Winter was in the habit of landing with his glass, and scanning the English Fleet from a neighbouring height. Occasionally they were cheered by a whiff of fair wind, but whenever it came, the tide was foul and they could not move.

So things continued till the 21st August, when the expedition, as it stood, was finally abandoned.

These conditions were pretty nearly the reverse of those at Brest.

The weather was so fine that it enabled Duncan to anchor off the Texel, and to make absolutely sure that the Dutch Fleet was thoroughly masked. He had all the advantages which steam could have given him. The Dutch, on the other hand, had all the disadvantages which dependence on the wind involved. Could De Winter have been supplied with steam for his motive power, how would history have been affected? Simply it appears that the Battle of Camperdown would have been the Battle of the Texel, and would have been fought by the Dutch when they were loaded with troops. The masking by Duncan would have been effective either way.

Lord Bridport had the reputation of being one of the most persistent and daring of blockaders. An Officer who had served under him wrote in 1799 that since Lord Bridport had "held the command of the Channel Fleet, the French have been blocked up in Brest harbour much closer than they ever were before. No Admiral at any time has kept Ushant so continuously on board as he has done; not a day passed, *when the weather permitted*, that Lord Bridport did not stand in; and when the wind would allow him, he has taken the fleet close in to the Black Rock; *his own ship the 'Royal George' has even been within it*, which, at the commencement of the war, was rarely done, even by 74's."

When it is pointed out that the Black Rock is 13 miles from the entrance to the Goulet of Brest, some idea can be formed of what was considered close work in 1799, and true explanation offered of the escapes and evasions of our squadrons which sometimes occurred.

One of the most remarkable of these occurred in this very year 1799, and under the nose of this most distinguished Officer.

In April, Admiral Bruix had at Brest 25 sail of the line, 5 frigates, and 5 smaller vessels ready for sea. On the 25th, Bridport, at the head of 16 sail of the line, but apparently only 1 frigate—the "Nymphé"—looked into Brest, and saw 18 sail of the line at anchor in Bertheaume Bay. Five others were under way, and those at anchor were ready for an immediate start (Fig. 1).

If we had not heard what has just been read, we should have been astonished at Lord Bridport's immediate proceedings, and would have said that he led up directly to the untoward circumstance which followed. He stood away to the W.N.W. at 2 o'clock in the afternoon, and at 4 was 12 miles W.S.W. of Ushant, or 30 miles from the French Fleet.

Only this one frigate, the "Nymphé," was apparently left to watch; and it may be that the "Dragon," 74, was somewhat detached towards the "Nymphé" for the purpose of repeating her signals to the Admiral.

The wind was fresh at N.E., and the French were there and then getting under way. The accounts are not clear as to whether the "Nymphé" became aware of the fact or not. There was foggy weather either that evening or next morning, or both, but the result was that at 9 o'clock next morning—the 26th—the "Nymphé" just caught the last ten or eleven of the French ships rounding the Saintes to the southward. The "Nymphé" made all sail to the N.W. to report, but at noon, when she was 15 miles W.S.W. of

Ushant, she had lost the French Fleet, and had not found her own. At 1 o'clock she saw the "Dragon," who repeated her signal to Lord Bridport, but it was then clearly too late. The French had six or eight hours' start. Lord Bridport, however, made sail for Brest, not apparently being satisfied with the "Nymph's" information; then discovering its truth, but not till the morning of the 27th, he fell back to Bantry Bay, being then and subsequently joined by ships which brought his number up to twenty-six. The French never, however, had any idea of Ireland; they were off to the Mediterranean, there to effect certain combinations, and finally to return to Brest, where they lay in overwhelming strength.

In this instance, Bridport was either intending to observe or to mask. As forces were on the way to join him, it is possible that he had not the intention of attacking Bruix in any case with his sixteen sail. But it is clear that he never meant to let the French Fleet out to be neither fought nor watched. Naval Officers of the day spoke of the escape of the French as "extraordinary." To us, now, it would seem to have followed naturally on Bridport's proceedings. But as Bridport was not at all the man to let slip a chance, we can only assume that the necessities of sails and wind compelled a course which to our modern notions would seem so mistaken.

But then the question for us here is, could this all have happened with steam fleets? Bruix again, as De Galles before him, had all the advantages which steam could have given him. He had that fair wind which steam represents, and he used it so that he must have been well on his way at breaking daylight on the 25th of April. Was there anything wanting to success beyond the absence of Lord Bridport? Would Lord Bridport have been absent if he had had a steam fleet? I take it that no argument can lie on the other side. Even if we allow that Bridport actually feared a battle when the odds were twenty-five to sixteen, and meant to risk the escape of the fleet rather than the chance of an action—still a withdrawal of 30 miles would never have been a necessity for a steam fleet in like disparity. But knowing what Lord Bridport was, and what his brother was, I can hardly believe that the risk of action would have weighed against the risk of the French escaping. I must, therefore, conclude that it was the dependence on wind which made it unsafe for a fleet to spend the night nearer than 30 miles from Bertheaume Bay. But if this be so, what a disclosure it makes of the real inefficiency of the observation, or the masking, of hostile fleets in their own ports during the last great naval war, and what a curious commentary on the generally received axiom that "Steam has bridged the Channel."

It is useful here to recall Nelson's proceedings in masking Villeneuve at Toulon, as it may remind us that tremendous as the effort was, it failed in the end, and left Villeneuve master of the situation.

We have to recollect that this operation differed in character from those carried on off Brest and other Atlantic ports of France, inasmuch as the blockade rested on a base 180 miles off—the base of the Madalena Islands, at the north point of Sardinia.

Nelson joined his fleet off Monte Christo on July 8th, 1803, and

spent sixteen continuous weeks, till the 31st October, watching Toulon. Then the fleet fell back to Madalena for ten days' rest and refit, frigates remaining on watch. From this date to the 19th January, 1805, there was an average interval of thirty-five days off Toulon to eight days at Madalena or Palma. In the year 1804 the fleet spent 306 days at sea, and yet Toulon was left practically open for two months out of the twelve. With a sailing fleet, retirement to a base 180 miles off must have been accepted as giving the escaping enemy three days' start at the very least, and it must have been known that the masking was thus abandoned.

It is hardly to be supposed that with a steam fleet resting on the same anchorage, the masking would ever be interrupted for a day. The whole fleet would never abandon the watch. The coaling, provisioning, and refitting would have taken place in the ships one by one. Madalena would have become a permanent *dépôt*, where colliers, store, and ammunition transports, would have assembled in safety. A ship detached from the fleet off Toulon in the morning would have been at Madalena for certain next morning, and might very generally have sailed the same night after completion. The work of watching would have been monotonous, but never hard, even in bad weather. In fine weather, when there was no sign of a move—no lighting of fires—on the part of the enemy's ships in port, communication by boat between the ships of the blockading squadron would naturally be free; and free also would be communication with traders loaded with all kinds of refreshments for the crews.

Pressed by conditions which the invention of the steam-engine has removed, Nelson was compelled to trust mainly to chance for masking the French. If he had had more frigates he might have had more warning; but in no case could the retirement of the squadron 180 miles be considered a maintenance of the masking. And thus it turned out; for though by good fortune the "Active" and "Sea-horse" were able to report to Nelson at 3 P.M. on the 19th of January the sailing of the French on the day before, yet in that act of reporting all trace of the enemy was lost. They returned quietly to Toulon, but Nelson knew nothing of it for a month, which he had spent in chasing vaguely to the east end of the Mediterranean.

Again this arduous but broken and incomplete watch was set up; and again the withdrawal of the whole fleet to Pula Roads in the south of Sardinia left the coast free to Villeneuve. But this time the news of the departure of the French was four or five days' old before it reached Nelson, and it was a fortnight more before the true destination was known.

We are easily tempted to ask, when the masking of Villeneuve was of such transcendent importance, how it was that line-of-battle ships were not detached in assisting the chain of look-out frigates. Nelson had certainly the idea in his mind; and after the first sailing of the French he told off his two fastest line-of-battle ships, the "Spencer" and "Leviathan," to act as a detached squadron, and to separate from the order of the fleet. But this was going such a very short way towards doing what we should now, with our present know-

ledge and want of knowledge, consider a very obvious duty, that there must have been very strong reasons on the other side. And then, too, arises the question, why did not Nelson detach one ship at a time from Toulon to Madalena? The idea is the first which occurs to our mind when we think of blockade resting on a base at the present day; it is not possible that it should have escaped our forefathers' notice.

I can only suppose that it was the slow and uncertain powers of locomotion possessed by the line-of-battle ships which made the thing impossible. Nelson took his fleet across the Atlantic in chase of Villeneuve at the average rate of 3 knots only. The difference between the sailing powers of the frigate and the line-of-battle ship were certainly very marked, and it was perhaps a physical impossibility in most cases for a line-of-battle ship to safely watch an enemy's fleet which had frigates at command. So, too, the idea of detaching single ships to refit could not have been put in force on account of the extreme uncertainty of the period of absence. Some such strong reason there must have been; but no such reason applies to blockade under steam.

We need not go further into the history of blockade under sail. The teaching is very broad and very plain. It is that a base of some sort was always necessary for a blockading fleet, whether such base was Torbay for Brest, Madalena for Toulon, or Gibraltar and Tetuan for Cadiz. That such base is as necessary, but not more so, with steam; but then with steam, communication with it has become so rapid, so certain, and so secure, that none of the interruptions enforced by dependence on the wind will tell against the closeness of the watch.

Again, the closeness of the watch under steam will be in marked contrast to its looseness under sail.

It may be true, and no doubt is so in some cases, that the steam ship requires more frequent communication with the base than the sailing ship, on account of the exhaustion of her fuel supply. But the modern economies of coal have a tendency the other way, and in any case the consideration does not touch the argument. The experience of the Federals, as well as our own during the Russian War, point to the seizure and maintenance of bases as an essential part of steam blockade. The command of the sea with locomotion independent of wind has—if we are to go by experience—bred an audacity in this kind of thing which far surpasses our seizure of Corsica, Minorca, or Malta. It seems plain that wherever we want the convenience of anchorage and smooth water we shall take it, so long as we can make it safe on the land side. For the blockade of ports near our own shores we shall use our own ports, and where those do not suffice we shall be found begging, borrowing, or stealing others.

It is evident that if the masking or observing of the enemy's fleets in the days of sailing ships was necessarily as loose as we have seen it, the actual *sealing up* was practically abandoned as hopeless. So far as the enemy's cruisers and privateers went, attempts at *sealing up*, if made, were singularly ineffective. Lloyd's Lists,

quoted in the "Naval Chronicle" for 1807, give a loss of 4,314 British ships to the enemy by capture in the nine years from 1793 to 1800 inclusive, that is four captures in every three days, and showing a freedom for mischief on the part of the enemy of a remarkable character.

Captures in the Channel and close off all our coasts appear to have been accepted just as wrecks and collisions now are. The "Naval Chronicle" supplied monthly lists of them without remark, and side by side with the wrecks; and the prizes, if not met by our cruisers in the open sea, which was often the case, seemed to have no difficulty in getting into French and Dutch ports. The mere conception of such a blockade as the Federals instantly prepared to set up on the Confederate coasts does not seem to have reached our ancestors down to the last, and we can only suppose that the presence of steam prompted the suggestion in the one case, as its absence excluded it in the other.

It appears to me that whatever opinions may be expressed now, if we had a naval war we should follow the example of the Federals exactly, and I suppose we ought to succeed as well as they did, provided always we are wise enough to sacrifice everything for the command of the sea. I cannot contemplate in this paper a policy which should assume our failure in this respect, because to assume it is certainly to draw away the money which is necessary to maintain it. The policy of the fox with his hundred defences against the hounds, never commended itself to me so much as that of the melancholy cat, sadly admitting that it had but the one plan of running up a tree if the cry of the huntsman was heard. The issue of the fable should not, I think, be forgotten by us when we are tempted to sail near the wind in the matter of naval economies. For the lesson of experience and of history is plain. It was the command of the sea alone which gave the Federals their bases, and thus their powers of blockade. The loss of the command of the Mediterranean Sea compelled the abandonment of Elba, in 1797, which had, in succession to Corsica, become the base for our fleet. In the war between Chili and Peru, the former, though superior at sea, were obliged to abandon the important blockade of Iquique, because of the possible interference of the Peruvian "Huascar."

The Federals, determined to take and keep the command of the sea, very soon set up a blockade based on it, which it has been rightly said is without a parallel.

"The old traditional idea of a blockade," says Mr. J. R. Soley, in "The Blockade and the Cruisers," "maintained by a few large vessels moving up and down before a post at a distance, gave place to the entirely novel practice of anchoring a large number of small and hand steamers in an exposed position close to the bar at the entrance of the blockaded harbours; and the boldness with which, after the first six months, men kept their vessels close in with the shore, and manfully rode out the gales at their anchors—a thing which sea-going men, as a rule, had regarded as impossible, and which would have appalled the stoutest captains of former times—showed as clearly as

the actual engagements the real stuff of which the Navy was made.

"As to the legal efficiency of the blockade after the first six months, there can be no question; and by the end of the second year its stringency was such that only specially adapted vessels could safely attempt to run it. . . . In the last year it became as nearly perfect as such an operation can be made. Taking its later development as a type, it is probable that no blockade has ever been maintained more effectually by any State; and it is certain that no State ever had such a blockade to maintain."

Be it recollected then the author is here speaking of sealing up; of operations which go very far beyond the masking or observing which would alone be vital to us in a state of naval war, and then everything vital to the safety of their own coasts was included in the sort of blockade which the Northern States undertook.

That the sealing up was not absolute is sometimes used as an argument that it was inefficient; and parallels are drawn adverse to our own blockading powers in naval war, which rest on that position. In some minds it would even seem that the escape of vast fleets in the days of sailing blockades was a better indication of what we may expect than the escape or entry of a small proportion of the flying blockade runners specially built for the service.

But surely it is certain that, setting aside for the present the effect of torpedo-boats, no squadron, not even a small one, could have evaded blockading squadrons, when the watch was so close that only a proportion of the attempts made by single ships were successful, and that these succeeded, not by escaping notice, but by running the gauntlet.

The opinion of the Wilmington blockading squadron was that one-third of the attempts to run the blockade out or in failed; and it was estimated that forty out of the sixty-six special blockade runners were captured or destroyed; but of course most of them had had more or less success before they ended their careers.

Captain Long in his paper has devoted a good deal of space to the attacks which were made on the outlying forts of the blockaded harbours, but although it be true that the possession of these forts was a very important element in absolutely completing the blockade, I do not think that anything of that sort comes within the scope of the present paper.

It seems to me that I ought to use only the actual blockading work of the Federals in order to form an opinion as to what our powers really are in this way, first considering steam alone; and then observing how far the advent of the torpedo-boat may modify the conclusions.

I think I may consider it established that the chief, if not the only, element in allowing the escape of our enemies' fleets and squadrons in the last naval war was the adverse action of the wind upon our own. We are now going to examine briefly whether the Federal experience in actual blockading work in 1861 to 1864 at all resembles ours at the close of last century. We are going to ask the Federals

quoted in the "Naval Chronicle" for 1807, give a loss of 4,314 British ships to the enemy by capture in the nine years from 1793 to 1800 inclusive, that is four captures in every three days, and showing a freedom for mischief on the part of the enemy of a remarkable character.

Captures in the Channel and close off all our coasts appear to have been accepted just as wrecks and collisions now are. The "Naval Chronicle" supplied monthly lists of them without remark, and side by side with the wrecks; and the prizes, if not met by our cruisers in the open sea, which was often the case, seemed to have no difficulty in getting into French and Dutch ports. The mere conception of such a blockade as the Federals instantly prepared to set up on the Confederate coasts does not seem to have reached our ancestors down to the last, and we can only suppose that the presence of steam prompted the suggestion in the one case, as its absence excluded it in the other.

It appears to me that whatever opinions may be expressed now, if we had a naval war we should follow the example of the Federals exactly, and I suppose we ought to succeed as well as they did, provided always we are wise enough to sacrifice everything for the command of the sea. I cannot contemplate in this paper a policy which should assume our failure in this respect, because to assume it is certainly to draw away the money which is necessary to maintain it. The policy of the fox with his hundred defences against the hounds, never commended itself to me so much as that of the melancholy cat, sadly admitting that it had but the one plan of running up a tree if the cry of the huntsman was heard. The issue of the fable should not, I think, be forgotten by us when we are tempted to sail near the wind in the matter of naval economies. For the lesson of experience and of history is plain. It was the command of the sea alone which gave the Federals their bases, and thus their powers of blockade. The loss of the command of the Mediterranean Sea compelled the abandonment of Elba, in 1797, which had, in succession to Corsica, become the base for our fleet. In the war between Chili and Peru, the former, though superior at sea, were obliged to abandon the important blockade of Iquique, because of the possible interference of the Peruvian "Huascar."

The Federals, determined to take and keep the command of the sea, very soon set up a blockade based on it, which it has been rightly said is without a parallel.

"The old traditional idea of a blockade," says Mr. J. R. Soley, in "The Blockade and the Cruisers," "maintained by a few large vessels moving up and down before a post at a distance, gave place to the entirely novel practice of anchoring a large number of small and handy steamers in an exposed position close to the bar at the entrance of the blockaded harbours; and the boldness with which, after the first six months, men kept their vessels close in with the shore, and manfully rode out the gales at their anchors—a thing which sea-going men, as a rule, had regarded as impossible, and which would have appalled the stoutest captains of former times—showed as clearly as

the actual engagements the real stuff of which the Navy was made.

"As to the legal efficiency of the blockade after the first six months, there can be no question; and by the end of the second year its stringency was such that only specially adapted vessels could safely attempt to run it. . . . In the last year it became as nearly perfect as such an operation can be made. Taking its later development as a type, it is probable that no blockade has ever been maintained more effectually by any State; and it is certain that no State ever had such a blockade to maintain."

Be it recollected then the author is here speaking of sealing up; of operations which go very far beyond the masking or observing which would alone be vital to us in a state of naval war, and then everything vital to the safety of their own coasts was included in the sort of blockade which the Northern States undertook.

That the sealing up was not absolute is sometimes used as an argument that it was inefficient; and parallels are drawn adverse to our own blockading powers in naval war, which rest on that position. In some minds it would even seem that the escape of vast fleets in the days of sailing blockades was a better indication of what we may expect than the escape or entry of a small proportion of the flying blockade runners specially built for the service.

But surely it is certain that, setting aside for the present the effect of torpedo-boats, no squadron, not even a small one, could have evaded blockading squadrons, when the watch was so close that only a proportion of the attempts made by single ships were successful, and that these succeeded, not by escaping notice, but by running the gauntlet.

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in fact, as those most competent to tell us, whether the story we have heard that steam has bridged the Channel is a true one, or whether, so far as their experience is concerned, the fact is not just the other way?

As I have said, when the Federals pronounced for a blockade of 3,500 miles of coast, embracing 189 harbours and inlets, they had practically no advantages to start with except the initial command of the sea. It is difficult to doubt that the whole conduct and issues of the Civil War would have been entirely different had this command of the sea been seriously disputed. It does not appear impossible that had the arrival of the "Monitor" in Hampton Roads on the night of the 8th March, 1862, been delayed sufficiently to have allowed the "Merrimac" to complete her victories, the initial command of the sea, on which everything hung, might have been lost.

But having the initial command, the Federals proclaimed the blockade, and proceeded to the sealing up of every harbour, creek, and inlet leading into the Confederate territory. At first, as might be supposed, there was no particular plan. Ships were sent as they could be procured off the principal ports—Wilmington, Charleston, Savannah, Pensacola, Mobile, New Orleans, Sabine Pass, Galveston, &c. The command was originally divided into the Atlantic and the Gulf squadrons, but latterly when the blockading forces became numerous the Atlantic command was divided into two, the north and the south; and the Gulf command also into two, the east and the west. At first the blockade was a mere hovering off the ports by vessels which did not remain long and passed on elsewhere; but soon, as ships of all sorts, sizes, and shapes, sailing as well as steam, began to accumulate, regular systems were adopted—systems which appear to me to have rested on the idea of "sealing up," and which would not have been the same had the ideas been of "masking" or "observing," though they obviously included both.

There was the old system of the in-shore and the off-shore squadron, with the difference that the in-shore squadron was the important one, and was continually pressed closer and closer in, while the outer squadron was spread over large areas as a sort of wide-meshed net to catch the fish which either had escaped or might escape through the other.

The in-shore squadron was sometimes at anchor and sometimes under way, according to the geographical and other conditions.

In the approaches to Charleston (Fig. 3) the in-shore squadron was in the first half of the war kept altogether outside the shoals, the off-shore squadron being beyond it. The Beach channel appears to have been the favourite one both for the entrance and the exit of the blockade runners. The attempts were always made at night, and there is no sign of much evasion in the matter. The ships appear to have been always seen, and always attacked both by the in-shore and out-shore squadrons; but they trusted to their speed and to their luck, and dashed through the in-shore squadron and out to the off-shore squadron, only being run ashore, rammed, boarded, or otherwise captured in a proportion of cases.

The in-shore squadron was generally forbidden to chase. If the ships could succeed in barring the progress of the blockade runner outwards, well and good ; but if they missed the opportunity, they had to leave it to the off-shore squadron to chase. There was very little warning either way. The entering blockade runner might very often escape notice altogether of the off-shore squadron on dark nights, and if so she was amongst the in-shore squadron without any notice whatever. Issuing from the port, it was certain that very little warning would be given. There was no such complete and accurate system of night signals as the world now possesses, though it had been designed a year before the Civil War broke out. The rough appliances of rockets and blue lights, incompetent to do more than give general warnings, were the signals most in vogue. As the blockade-runner showed no lights, it was only the ships who were close to her that saw her at all, and mere general alarm signals from these ships were not of any use in directing the course of blockading ships at a distance, and there must have been a want of concert which a more accurate and complete system would have removed.

But, again, we must recall the fact that it was sealing up which was aimed at—actual blockade. It was not the defence of the Federal coasts or the Federal shipping which caused the assemblage of such numerous blockading squadrons ; it was injury to the Confederate territory, the cutting off its supplies, and especially its supplies of contraband of war, that was the Federal object. It was the ingress, as much as, or perhaps more than, the egress which was to be checked. Hence a disposition of the ships blockading which might not have obtained had the object been the masking of war fleets, squadrons, or single ships. The concentration of a large in-shore squadron close to the entrances of harbours would not be the most obvious arrangement for observing or masking. The strength would be in the wrong place if these were the designs, because the blockade runner, whether ship, squadron, or fleet, had but to make the dash, and, if not stopped, would be free.

The plan which would suggest itself where egress and not ingress was to be checked, would be but a few of the smallest, lightest, and fastest vessels, with the most perfect signal appliances, close to the entrance to the harbour, and the fighting ships proper in an arc-like chain in the offing. It would be the duty of one of the light observing vessels to follow the escaping vessels seawards, continually informing the off-shore squadron of the whereabouts of the chase, in order that a sufficient force might be concentrated upon it.

We must, I think, never forget this double duty of preventing equally ingress and egress, which devolved upon the Federals, and we must put the question to ourselves whether, had egress alone been the thing to be stopped, there would have been even the proportion of exits which there were. Blockade, I may repeat, is a vital operation to us only so far as regards egress. If we can prevent war ships escaping outwards we should be disposed to encourage their escape inwards as so much off our hands.

But, as it was, blockade running at every one of the Confederate

ports became gradually impossible, except to specially built and prepared vessels. Some of these undoubtedly had wonderful success, which may easily support the arguments of those who say that the days of blockade are over. The late Hobart Pacha made six successful voyages to Wilmington in the "Don," but she was captured directly he left her. The "E. R. Lee," under the command of a Confederate Officer who had been in the United States Navy, actually ran the blockade twenty-one times in ten months.

On the other hand, we read of the "Nashville" lying for eight months in the Ogeechee river blockaded by three gunboats, and utterly unable even to make an attempt to escape.

As I used the escapes of large fleets and squadrons in the days of sailing ships to illustrate the looseness of blockades, so I may usefully illustrate the closeness of a steam blockade by one or two of the most striking escapes of single ships.

One of the most daring was that of the "Sumter" from the Mississippi on 30th June, 1861 (Fig. 4). She was blockaded in Pass à l'Ouvre by the "Brooklyn" and "Powhattan," off its mouth, but owing to the double duty which was thrown on these ships of guarding ingress as well as egress on this particular day "Powhattan" was absent, and "Brooklyn" was in chase of a sail to seaward. "Sumter" seized his opportunity in broad daylight, and crossed the bar of the pass when the "Brooklyn" was $3\frac{1}{2}$ or 4 miles from it. She was reported to have 13 knots speed, while "Sumter" could only get between 9 and 10 knots. The "Brooklyn" instantly made for the "Sumter," and it very soon became a stern chase, both being under sail and steam; but the "Sumter" lying closer to the wind was able to compel the "Brooklyn" to furl her squaresails, and so to gain upon her. The "Brooklyn" soon gave up the chase, and was never near enough to open fire on the Confederate ship.

On another occasion, but this time in darkness, the "Sumter" evaded the blockade of a single ship. She found herself in the open Bay of St. Pierre, with her stern tied up to the shore, and blockaded by the Federal ship "Iroquois." St. Pierre being a neutral port, the "Iroquois" could not attempt a really close blockade, but she made arrangements with a merchant schooner to display certain signals to her in the event of the "Sumter" making a move in the night. Captain Semmes thought that these signals would be two only, denoting that the "Sumter" was off to the northward, or was off to the southward. In this belief the "Sumter" slipped her hawsers and made off to the southward under the land. Those on board her saw the schooner show two red lights, which they took to be a signal that they were off to the southward; they could also make out the "Iroquois" with their night glasses, but in the shadow of the mountains as they were, they rightly assumed their own invisibility. As soon as they were assured that the "Iroquois" was off full speed to the south, the "Sumter" turned round and made off full speed to the north, and got away without being chased.

The "Alabama" performed the same feat under the same commander a year later. This time it was from Fort de France, Marti-

nique, the blockading ship was the "San Jacinto," which Semmes contemptuously calls an "old wagon." The night chosen was dark and raining, and the "Alabama" merely trusted to her luck, and ran out under a full head of steam by the most southern route without catching even a glimpse of the "San Jacinto."

The double achievement of the "Florida" in breaking the blockade inwards and outwards at Mobile has attained a just celebrity. She was only half fitted and half manned; it was an absolute necessity that she should get into a Confederate port for completion, and Mobile was chosen. This was in September, 1862, and the ship was then at Cardenas in Cuba. The force blockading Mobile consisted of the "Oneida" and five gunboats, but at this particular time all were absent but the "Oneida" and the "Wincona" gunboat. One of the gunboats had gone to take post off one of the Mississippi mouths which was left unguarded, and three others were away for repairs or coal. The frigate "Susquehanna" had been off the port, but she, too, was away for repairs at Pensacola.

The "Florida" approached under English colours in daylight, and the "Oneida," not expecting a ruse, and supposing her to be an English man-of-war intending to ask permission to enter the port, steamed out to her. The "Florida" simply took no notice; profited by the momentary hesitation of the "Oneida," and passed on at full speed. The "Oneida" was not long in opening fire, and planted several shot and shell in the hull of the "Florida," to which the latter made no reply, and she escaped across the bar, if not in safety, at least without fatal damage. Captain Moffit of the "Florida" was of opinion that had the "Oneida's" guns been better laid she would have ended her career there and then.

This plucky commander made his escape through a blockading fleet of seven ships four months later, choosing a dark night and a northerly wind; she made out the blockading ships before darkness came on, when she moved down to the bar. They, too, saw her, but seem to have made very incomplete arrangements to intercept her. The "Oneida" remained at anchor and did not even weigh when the flagship, the "Susquehanna," made the signal for a blockade runner. Another ship, owing to certain formalities enforced on board her, did not slip till half an hour had elapsed. Only one ship, the "Cuyler," really gave chase, and she followed up for the rest of the night and the whole of next day. But the "Florida" evaded her the second night, and was safely engaged in burning Federal vessels the second day.

The risks that these and other single vessels ran in making these escapes; the numbers that failed; the inefficient and temporary character of so many of the blockaders; all seem to show that it was much easier for whole fleets to escape to sea in the days of sail than for single ships in the days of steam. It may now be held, on the strength of the great American experiment, that it is as difficult, but not more so, to prevent the exit of single ships in the days of steam as it was to prevent the issue of vast fleets in the days of sail.

I have been anxious to get the question clear for argument as to the

influence of steam alone on the question of blockade. Having done so—as far as the limits of time will allow—we must add to the question as it stands the influence of the torpedo-boat. That being, so far as I can see, the only change in the “conditions of warfare” as affecting all natures of blockade since the termination of the American Civil War.

It is constantly held that owing to the absence of interior naval force in the ports blockaded by the Federals, they were able to take a position and to do things which would have been impossible had there been such force. I can grant that had the Confederates been in any way able to dispute the command of the sea with the Federals, the whole programme of the latter would have been upset, but the facts are against the theory that the Federals were not liable to attack issuing from the blockaded ports. They were very generally liable; they were often attacked from within, and sometimes were beaten off. Yet the command of the sea made an unfavourable issue of these combats of minor importance. The only one where the issues were really critical was the attack by the “Merrimac,” of which I have already spoken.

In March, 1862, the Elizabeth and the James rivers were blockaded by the following Federal ships lying in Hampton Roads:—The “Congress” and the “Cumberland,” sailing frigates, were lying at anchor at the mouth of the James river; the “Roanoake” and “Minnesota,” screw frigates, lay further down towards the sea; there, too, was the “St. Lawrence,” a sailing frigate like the “Cumberland.” The “Roanoake,” though a steamer, was disabled in her machinery, and was unable to move except by the assistance of tugs. It was known to all these ships that up the Elizabeth river, at Norfolk, the Confederates had nearly completed turning a sister vessel to the “Minnesota”—the “Merrimac”—into a river-service ironclad. They knew also that there were steam gunboats up the James and Elizabeth rivers, and they expected an attack with the object of raising the blockade of the roads and rivers.

On the 8th of March the “Merrimac,” accompanied by two gunboats, came out of the Elizabeth river and proceeded to the attack of the “Congress” and “Cumberland;” three gunboats came out of the James river to assist. The “Minnesota,” under her own steam, got under weigh to repel the “Merrimac’s” attack, but soon ran ashore in such a position that the “Merrimac” could not get within a mile of her. The “Roanoake” also weighed, and was presently towed ashore by her tugs. There she helplessly watched the “Merrimac’s” destructive powers, and, being at length got afloat, dropped down to her old position. As she was dropping down, the “St. Lawrence” was being towed up to the attack of the “Merrimac,” but she also presently went ashore, and took no effective part in the day’s proceedings.

The “Merrimac” and her consort gunboats went straight up to the “Cumberland.” She fired into her, rammed her, and sank her in a very short time. While she was thus destroying her, the gunboats opened so heavy a fire on the “Congress” that she was fain to make

sail and run ashore, where she was afterwards burnt by the "Merrimac's" shells. On the approach of darkness the "Merrimac," satisfied with her day's work, withdrew to her own side of the river. She felt herself in command of the sea and of the situation, and designed to complete the work next day at her leisure.

But from the sea, at 9 o'clock that night arrived the "Monitor," the Federal answer to the "Merrimac"; and when next morning she got under way to settle the business with the "Minnesota," still on shore, she found beside her a little new-fashioned engine of war with scales as hard as her own, and with guns whose shot, though they could not penetrate, were at least able to break up her plating. The "Monitor" was, in fact, able to cover the "Minnesota," owing to the shallow water in which the latter lay, and in the result the "Merrimac" withdrew to Norfolk without having added at all to her victory of the day before. The Confederates had lost the command of the sea and had failed to raise the blockade.

In April, 1864, the squadron blockading the Roanoke river knew that they might expect an attack from the "Albemarle," an ironclad which the Confederates had constructed up the river. The Federal force was only two small steamers carrying each a rifled 100-pr. and five or six 9-in. smooth-bores, and two tugs. On the 18th of April the "Albemarle" came down the river by night, made straight for one of the Federal ships—the "Southfield"—rammed her and sank her, the crew escaping to the other which was alongside her. This ship, the "Miami," and the tugs then disappeared beaten, down the river, but remained at its mouth, while the "Albemarle" lay alongside the wharf at Plymouth.

The squadron off the mouth was reinforced by three more powerful steamers, and, on the 5th of May, the "Albemarle" came down and fought an indecisive action with the whole of them, which, being without distinct advantage to her, left things as they were. As is well known, she was a few months later destroyed by Cushing with a spar torpedo, while she lay alongside the wharf miles up the river at Plymouth.

A bold attempt to break up the blockade at Charleston was made in January, 1863. Two ironclad rams which had been prepared inside the harbour—the "Chicora" and the "Palmetto State"—taking advantage of a thick haze, crossed the bar, and boldly approached the numerous vessels—ten or more—outside, which were spread over an arc five or six miles in length. In a very short time the Federals, "Mercedita" and "Keystone State," had hauled down their colours. They were on fire and leaking, while the rams were uninjured, but not being taken possession of, were recovered by the Federals. The fight lasted from 5 till half-past 7 in the morning, and then the rams returned into port.

The "Atlanta" was an ironclad converted from her old service of blockade runner by the Confederates at Wilmington. In June, 1863, the "Monitor," "Weehawken," and "Valiant," had knowledge that they would be attacked by the "Atlanta," and on the 17th they advanced to meet her as she came down the river. The whole thing

was over in a few minutes. The "Weehawken" fired five shots from her 11-inch and 15-inch guns; four of them struck the "Atlanta" and did her such damage that she immediately hauled down her colours.

The blockading squadron at the head of the passes in the Mississippi (Fig. 4), consisting of two sailing sloops, a steam sloop, and a paddle steamer, were driven down the passes on the 12th October, 1861, by the ram "Manassas," escorting fire rafts. Not much damage was done by either, but it was not considered feasible to maintain the position, and the blockade was in consequence partially raised.

Galveston had been taken possession of by the Federals, and became the base of the blockading squadron. In December, 1862, they were led to expect a combined attack by Confederate ships and troops. The former were two river steamers armoured with cotton bales. They captured the "Harriet Lane," and the "Westfield" was abandoned and blown up. Galveston fell again into the hands of the Federals, and the blockade was raised.

From this brief review it appears that the presence of the blockading forces was nearly everywhere contested from the inside; and that though it may be true that neither of the combatant forces were on a large or efficient scale, yet proportionately, the Confederate efforts were never to be despised, and often they were critically near success. What they wanted and never had was the power of attack from the sea, and it is obvious that, as I have already remarked, even a temporary power of that sort might have changed the whole face of the war.

If the naval forces of England should have to engage in blockading operations against a naval Power, they would in the first instance be liable to the attacks similar to those which the Federals experienced. But undoubtedly the particular force which promises to interfere most with blockaders is that of torpedo-boats, I must not say torpedo-vessels, for if torpedo-vessels are to take a large place in war, they will take it in the open sea, and as the equals of any other form of open sea naval force. That is to say, they will be the rivals of the fleet ship as at present developed, and aim themselves at becoming the fleet-ships of the future, as claimed by M. Gabriel Charmes. But the torpedo-boat does not in any way claim to take the place of the fleet ship. It tends to operate outwards from the land, and not inwards from the sea. It is more a prospective terror than an open match for the ironclad; and its cheapness combined with its assumed destructive powers makes it especially the weapon proposed for the driving off of masking or observing forces in the operations of blockade.

It is, as I have said, not uncommon to hear naval Officers—and some of the best informed—express the opinion that the torpedo-boat has made blockade a thing of the past. I do not think a calm well-reasoned judgment can accept this view. It is almost obvious, however, that if the Confederate ports had swarmed with torpedo-boats, the in-shore squadrons could not have been safely so numerous, nor could they have pressed in so closely nor so perseveringly.

But I have endeavoured to show that we may be misled by the American experience. To us the sealing up of the enemies' ports can rarely be the object. It was for America part of the "Anaconda" policy—a policy resting on the power of almost entirely surrounding the enemy with an impenetrable wall. We are not in a position to attempt such a thing with any country, and consequently our blockade will seldom extend beyond masking and observing—to measures of defence not of attack.

What are the necessities of this policy? Not surely large in-shore squadrons? A single observing ship close in to the port, designed to evade the most modern forms of attack, and with her signalling powers developed to the utmost, is all that is necessary for all purposes of observing, when she is in communication with the real force off shore. We see the bases of such observing ships in the new "torpedo catchers." They will have a speed which makes the actual attack of torpedo-boats remote; they will have a draught of water, not only enabling them to press into the shallows about the port, but rendering the chances of a blow from the locomotive torpedo uncertain. Three or four of such vessels forming an in-shore squadron, always closing in and lying quiet at night, and drawing off as daylight breaks in the morning, would keep quite as close a watch on the egress of the enemy as the numerous vessels of the Federals were able to do. They would naturally be powerless to prevent ingress, but as I have said, that would be immaterial to us. In the case of vessels or squadrons attempting to escape by night, it would be less the duty of these ships to engage them, than to hang on their flanks and continually report their movements by signal to the off-shore squadron, which would detach and concentrate sufficient force to intercept the runaways.

If the in-shore observers were attacked either by like forces, or such as might be supposed superior, they would either fight them or draw them off, taking care however that some of their number should evade action for the purpose of keeping up the watch. No doubt the work of these observers would require all the skill, daring, and perseverance that the Navy has always been accustomed to show, but it would not be of the harassing character which those of the Federal in-shore squadrons was. And this, simply because they would be relieved of the anxieties due to watching ingress. There would be gallant fights, there would be reputations lost and won, but I am persuaded that the watch would be maintained. The experiments at Bantry and the North of Ireland were not such as to discourage us. Nor is there anything in Federal or Confederate experience against us. It may be true that dark misty nights will favour the enterprise of escape; but they will also favour the closer and more intimate watch. The same veil which tends to hide the blockade runner outwards, tends to hide the observer of his movements.

But those who think that the torpedo-boat has destroyed the powers of blockade—that is, of masking and observing—think more of the fighting force—of the off-shore squadron—than of these specially prepared watchers.

But here we want to recall that all questions of attack and defence are matters not of dramatic romance but of common sense and reason. The Fleet proper need not expect every kind of attack without notice. If its watchers fail to keep it warned, there is practically only the torpedo-boat attack which can be delivered as a surprise. In this attack, the net defence, though perhaps not a perfect one, is yet a considerable safeguard. I know of no reason why this net defence should not be trusted to at night and in all ordinary moderate weather. I do not know why the ships of the fleet cannot be maintained in such a fair approach to order, with their engines occasionally moving, and their nets down, as may not make a surprise by torpedo-boats a thing to be less feared—even if our commanders did not go so far as Hobart Pacha in their contempt for this form of naval warfare.

A hostile fleet can hardly drop from the clouds on a blockading fleet so situated, but were such a thing to happen, drill should make the passage from the condition of waiting torpedo-boat attack to bristling with life and movement on the approach of a fleet, a very rapid one.

Very bad weather, or even bad weather, is of itself a security against torpedo-boat attack.

And then we have to recollect that for the blockaded enemy all attack is a matter of reflection and reason. He will not deliver it in any form against any part of the blockading forces unless there is at least a chance of success. No doubt his efforts against the in-shore observers will be more or less incessant—when he can find them. But I take it that the escapes of the "Sumter" and "Alabama," which I have narrated, tend to remind us that small vessels designed to be hidden are not always immediately discoverable. The chances, in fact, are even for both sides. If the weather is clear, the watchers can keep their watch at greater distances. If it is thick, they can close in with the less chance of being discovered. Clear weather and thick weather do not assist or hinder one side more than the other.

And it is so with the off-shore fleet. A torpedo-boat flotilla will not quit the harbour for the attack unless there be some reasonable hope of finding the off-shore fleet, and this need not disclose itself except in answering the signals of the in-shore observers. But this disclosure presupposes warning, and is so much against the hopes of the torpedo-boat flotilla.

These are the general reflections which my historical examination of this most momentous question has called up in my mind. They are, if well founded, very encouraging, but my whole paper seems but to utter but a single warning. Keep the command of the sea as you value the national life. With it you can do everything. Without it you will speedily be blotted out from the list of great countries.

The CHAIRMAN (Sir Cooper Key) : We shall be very glad to hear any gentleman who wishes to criticize or to make any remarks on any part of Admiral Colomb's valuable paper. I see several Torpedo Officers here ; I am sure they would like to stand up and endeavour to prove that Admiral Colomb is quite wrong.

Admiral Sir E. FANSHAWE: In order to set the discussion going, I should like to express my humble opinion that so far from Admiral Colomb being wrong, I think he is very right in adopting an historical basis in reasoning upon questions of future naval war, duly taking into consideration the alterations and modifications which have been made in naval warfare by recent applications of science. I cannot conceive any other sound and proper basis for reasoning upon warlike operations than the fundamental principles upon which war at all times, in all ages, and under all circumstances, has been conducted. I therefore think that Admiral Colomb has adopted a sound and good basis in founding his lecture solely upon history. The lessons he has deduced from the individual cases he quotes appeared to me, on reading this paper, to be extremely well applied, and the cases themselves well chosen. I make these few observations with a view of starting the discussion, but certainly not of criticizing any point that Admiral Colomb has made, being very much inclined to concur in his arguments and adopt his conclusions, speaking generally, as being sound and true.

Rear-Adm. the Hon. E. R. FREMANTLE, C.B.: I entirely agree with the Chairman that it is the business of Torpedo Officers to take up these questions, and to say what can be said as to the difficulties of carrying out a blockade with torpedo-boats inside. As a general rule I do entirely agree with all that has fallen from the able lecturer on this subject, and certainly, as has been so well said by Admiral Fanshawe, that the historical basis is unquestionably the right one to adopt. It is worth while at the risk of repetition to say that, because we know that there is a very large body of naval Officers who hold the idea, which I think is an erroneous one, that nothing can be based upon the experience of former naval wars. I wish, however, to be bold enough to a certain extent to criticize the lecture. I regret certainly that in treating of blockade the lecturer has not followed up his subject of "convoys" by treating of the civil blockade, for there is a great deal to be learned from that; but I agree that it is scarcely possible to treat both civil and military blockade in one lecture. I certainly should have preferred at this moment that following up his previous lecture he should have treated of civil blockades, because there is a great deal to be said about it, and a great deal which I think might be added on questions of convoy and blockade to what fell from the numerous gentlemen who spoke on the lecture to which I am referring. That, however, is not the subject before us. In treating of a military blockade solely as a question of preventing egress, I think the lecturer has fallen into a slight mistake. I am sure that he will admit in the illustration he gave, that of Admiral Colpoys cruising off Brest and of Admiral Richery joining the Brest fleet, it would have been a very important part of Admiral Colpoys' duty, and I do not think he would have thought differently, to have intercepted, if he could, that junction of Admiral Richery's with the Brest fleet. No doubt the junction had been arranged so as to command the British Channel, and, therefore, for the blockading squadron to succeed in preventing the ingress of ships was quite as important as their arresting the egress of ships. On the question of military blockade, as I said before, I am in entire agreement with the lecturer. I recollect reading in M. Gabriel Charmes' works, quoted by the lecturer, how he drew a clever picture, making it almost convincing to everybody who read his works on the subject, of an ironclad with steam up to the highest point, boilers at full measure, employed in blockading. He showed how impossible it would be to be always prepared, and how they would probably find when the torpedo-boats came out that the boilers were out of order, and how, notwithstanding the greatest care on their part and all the efforts that they might make, they would not be able to get their full steam up at the moment it was wanted. That was an extremely graphic picture, but it certainly did not represent naval war or blockade. In going to history the lecturer has shown us very plainly where we shall find one fact on this subject. There was then and there certainly will be in future an in-shore squadron and an out-shore squadron. He might perhaps have spoken a little more of the Berehaven operations, where we know we had an in-shore squadron, with torpedo-boats and small vessels, and an out-shore squadron. I believe myself that the torpedo-boat in-shore squadrons will be a very important part of future blockades in fine weather; in bad weather they may be eliminated altogether from consideration, and then we shall come to the question as

it has been put by the lecturer. I believe, however, that in fine weather we shall find torpedo-boats playing a great part. No allusion has also been made to our recent history of blockade in the Greek waters. It has been published confidentially, and I have had the advantage, which perhaps has not been enjoyed by every Officer, of reading the able report of His Royal Highness the Duke of Edinburgh on that point. It is not for me to say exactly what those conclusions are, nor to divulge what has been issued confidentially by the Admiralty, except that in that case the torpedo-boats were used principally to prevent both ingress and egress, and they were used by the blockaders and not the blockaded. Having said that much, I do not in the least deny the great strength that the torpedo-boat, as it exists, gives to the defence, and should there be a certain number of these boats inside a port doing their best to prevent the blockaders effecting their purpose, it will be extremely annoying and dangerous under certain circumstances. Still they will be met by their equals, and all considerations which are based upon one side or the other having the advantage are in my opinion far fetched and impracticable. I am sure we have had a very able lecture, but that indeed we may always depend upon when Admiral Colomb is the lecturer. I can only regret that there are not more people here to-day to add their quota of thought and admiration as to the way in which this subject has been treated. I am quite sure of this, however, that everyone will read it when it is printed in the Journal, although they cannot now be present to discuss it.¹

Commander CAMPBELL : I rise, not so much to discuss the paper, as to try and accentuate one or two points with which I particularly agree. It is clear that Admiral Colomb has added another chapter to the many brilliant achievements that he has at all times made in this theatre, in the many papers which he has read, and which to us young Officers I may say have been invaluable. In the first place Admiral Colomb's nomenclature suggested itself to me as being so good, the terms he uses for describing the operations of blockading, masking, and observing. I am sure that whenever thinking over the question of "blockade" we shall always find those terms most useful. I do not quite agree with Admiral Colomb as to the "great number of naval Officers who hold the opinion that it is worse than useless to go back to naval history for the lessons of modern naval war," because I believe that the number of Officers is increasing very rapidly who place a high value on historical retrospect. I will, however, go further than the two speakers who have preceded me, and say that you cannot obtain one glimpse of the future except through the medium of a reflected past. You are at a dead loss without history in naval prediction. Ship-building is a matter of naval prediction altogether based on historical retrospect. You are obliged to be a predictor, but if you have no data upon which to regulate your predictometer, I do not know how you are to predict with accuracy at all. I cannot pass without comment the tactics of the cat and the fox mentioned by the lecturer. That one plan of the cat commends itself to me, and will be used by the blockaded fleet as long as they remain inside; but if they, or any portion of them, attempt to come out they will assuredly use the hundred dodges of the fox in order to escape the watchful huntsman and his hounds. Admiral Colomb winds up by saying that we must have command of the sea! I

¹ I should like to add more decidedly my opinion, confirming as I understand that of the lecturer, that blockades are not only possible now, but far more practicable than in former days. The argument is that fast steamers and torpedo-boats inside render blockades difficult if not impossible. It might similarly be argued theoretically with regard to military operations that to surround an army armed with modern long-range weapons was an impossibility, and I have a strong opinion that had no wars arisen to prove the fallacy of such views, this would have been the prevailing notion. We have proof on the contrary that improved weapons have given increased power to the stronger side to hem in an enemy, and so clearly has this been shown to be the case that though Mack's surrender of 36,000 Austrians at Ulm in 1805 has been held by historians to be discreditable to that Officer, the surrender of three times that number at Sedan by Napoleon III and De Wimpffen in 1870 has generally been accepted as inevitable under the circumstances.—E. R. F.

cannot tell you how fully I agree with him there, but the question we have to discuss must be how we are to maintain that. No doubt it will be by blockading, by cruisers destroying the enemy's trade, by watching his ports, but if what we hear is true from the report of a very able Admiral on the other side of the water, we shall find that in future they would rather come out and attack our force than stop in and be blockaded by our fleet. That naval Officer reported to his Ministers that he would not be afraid to meet the enemies of his country at sea after the great operations he had gone through, even, as he said, if he met the vessels of that nation which had the reputation of being the most powerful on the seas. I can only say I believe our naval Officers would be very glad if that Officer carried out his words; it would perhaps save us the trouble and hard labour of blockading in the future, for evidently it must be incessant hard work day and night, and it would give our Admirals and Captains some exhilarating moments, and our Commanders and Lieutenants a flow of promotion in keeping with the rapidity of the times in which we live. I am sure we must all thank Admiral Colomb for his very able paper.

Captain WILSON, R.N.: It is really hardly fair to criticize a lecture of this kind without carefully considering it beforehand. I had no idea, when I came here, what line Admiral Colomb would take, and not having seen the paper previously, one is not prepared to meet his arguments right off. I can only suggest one or two things. I think in his quoting the case of the Federals against the Confederates, the American Civil War, he has greatly underrated the enormous preponderance that the Federals had over the Confederates. You could hardly consider the Confederate naval force as any force at all. When we come to deal with any European Power which has a navy at all, we cannot count on anything at all proportionate to such tremendous preponderance as they had. Another point I think he has overlooked in his lecture is the immense advantage the blockaded has in selecting his time and place to begin his attack. If the blockaded has any power at all, he can concentrate that power, whatever it is, on any portion of the cordon that the enemy is forming round his port. His attempt to escape would be made during the night, and I do not think it would be so difficult to get out as Captain Colomb supposes. Captain Colomb, rather inconsistently in one case, pointed out the difficulty of the enemy getting out, and shortly afterwards he pointed out the great doubt there was whether the torpedo-boats would find the enemy if they came out to attack him. If you go out and do not find the enemy you are clear, and your object is gained. The attack of the blockade would generally be made solely with the object of forcing his way out. If I was blockaded in a port with one or two cruisers that I wanted to get to sea to prey on an enemy's commerce, the natural way of forcing my way out would be to make a rush for the weakest point with my cruisers that meant to get out and use whatever torpedo-boats I had to make an attack at the same time. If the enemy does not discover you, your cruisers get to sea; if he does discover you he must give chase, and while he is in chase is the very best chance for the torpedo-boats to make their attack. In the first place, they see a large ship much better than they are seen; then they can choose their time when he is perhaps just gaining on the escaping ships and rush down with the advantage of their own speed added to that of the enemy approaching. There is no safer way to attack than to attack from ahead when the enemy is steaming at high speed. As to the use of torpedo-boats in the blockading squadron, it must entirely depend on the distance of their base of operations. I should not suppose our present boats are capable of keeping the sea for any considerable length of time without the means of going to a neighbouring port pretty often, and at an enemy's port distant from our own coasts, you may consider that the blockading squadron won't get torpedo-boats except on rare occasions. They will have of course the torpedo cruisers and perhaps second-class torpedo-boats. Another point is the great difficulty the squadron lying off the port has in keeping steam ready for the high speed that vessels inside the port can maintain. A vessel coming out of port chooses her own time to come out with her fires cleaned and a full head of steam ready, while vessels outside will get their fires dirty whatever precautions they take. Their fires being banked for a long time they will be getting very low, and they will not have steam up for an hour or two after they try to get up full

speed. Therefore the escaping vessel always has an advantage. The conclusion I should arrive at is that a blockade is still possible, but that the preponderance of force on the part of the blockader must be enormous if it is to be so complete as to prevent cruisers getting to sea. The true time to catch cruisers is not when they are coming out of an enemy's port, but to lay off the ports where they are obliged to go to on purpose to coal, and capture them when they are returning.

Rear-Admiral COLOMB: I am very much obliged to the different speakers for the commendation they have given to the paper, and I am glad to find so much more agreement with me than I expected to have found. I augur well for the Navy that there should be that agreement, because I feel that what we have been talking about to-day must be our chief duty in any coming naval war. Admiral Fremantle seemed to think I had not laid stress enough upon the necessity of preventing ingress as well as egress. My point would have been in the instance that he brought forward—my own instance of Richery escaping from Rochefort—that Richery would not have escaped from Rochefort, because Sir Richard Curtis would not have gone to England with his squadron. Of course if some fleets are to be left unguarded and squadrons are to be loose about the sea, that gives that partial command of the sea which I think we ought not to admit. I do not mean to say it might not happen sometimes that a squadron would escape, but what I meant was generally speaking the ingress is a thing that we need not trouble ourselves much about. I quite agree with Admiral Fremantle when he speaks of the possibility in fine weather of torpedo-boats doing a good deal of watching in-shore in certain conditions and ports. It would be so no doubt, as in the instance he brought forward of the Greek blockade. He spoke of M. Gabriel Charmes. M. Gabriel Charmes is, I believe, an uncertain guide, because he resolutely objects to history of any kind. He brings instances forward and so on, but he never seems to miss an opportunity of saying that you must not think of anything that has gone past, you must simply look to the future, and you must draw the material for looking to the future from somewhere up in the sky, and not from anything on earth. Captain Campbell rather heaped coals of fire on my head, because I was more hostile in my criticism of his paper than he has been of mine, but I will say *tu quoque* to him in the matter of nomenclature, as I am certain I shall never forget his phrase, "that the carrying of masts and sails is sinful." We owe that phrase to him. I think also that I shall always recollect the phrase, "predictometer," therefore I think I may simply say that I have turned the tables upon him. The real criticism of course comes from the man most able to give it, but I do not think it has quite converted me on the question of the attack by torpedo-boats of blockading squadrons, and of what blockading squadrons would do to avoid it. He speaks of the enemy making attacks on the weakest part of your squadron, but from my point of view it is impossible for him to say what is your weakest point, because I do not think you would ever keep more than a very few light ships close in. You would be continually changing those ships, they would do nothing whatever but just watch, they would keep as close in as possible, and would not be fighting ships in any sense of the word. They would be able to show fight against ships of their own class, but they would run for it if attacked by a superior force, and therefore the blockaded force would have no means of ascertaining where your weak point was.

Captain WILSON: What I meant was that you would study the habits of the blockaders, and in that way find out their weak point.

Admiral COLOMB: I do not think you could ever learn what his habits were, because all that you would generally see of him would be the two or three observing vessels that would keep close in. Their duty would be simply to watch and report by signal; that report would be carried on by one or more intercepting vessels two or three miles off, according to the geographical conditions of the harbour. Your fighting force would seldom be seen, so as to make it as difficult as possible for the torpedo-boats to know where to go to when they got out of harbour. There would be an immense area over which your fighting force might be, so that I do not think your enemy would ever know where your weak point was. There is a matter which we do require to think of very carefully, and that is the point which Captain Wilson brings forward as to the efficiency of ships blockading, with regard to the state of their fires. The observing ships close in would

have continually, one at a time, to be running in and out and to keep steam going, and one or two of the ships of the real fighting force that might be called on to chase would also be kept running up and down during the darkest hours at any rate, so as to have their fires in good order. It would, however, be impossible for the whole fleet, whether the in-shore or the out-shore squadron, to do that, but some arrangement would have to be made, because unquestionably the great difficulty of preventing a rush would be the state of the fires of the ships which had them more or less banked. I want to say this, the point of my paper as I understand it is, that the whole of your naval and military policy, so far as the defence of the United Kingdom is concerned, depends entirely upon this question of blockade. The whole of the vast sums you spend upon your army, fortifications, and the different arrangements for the defence of the United Kingdom depend entirely upon whether or no you can maintain sufficient force off the enemy's port to prevent his getting out without being fought. That being so it is singular that so little attention has been paid to what I have endeavoured to bring before you today. It is expected almost everywhere that we are to have hundreds of thousands of men thrown upon our shores. They are to turn up in Sussex, or round London, and in all directions. They could not possibly do it unless there were large fleets to support them, and yet we never seem to consider for one moment whether those large fleets can be kept in their own ports and prevented from coming out to support the army. When you omit to consider the primary question of the possibilities of blockade you run into inevitable and enormous expenses to which there is no check and no possibility of curtailment, because the question of your army simply rests, as it does in the minds of many military men at this present moment, upon the number of men in arms in Europe: and until we have got a force equal to the whole of Europe in arms on our own land the military necessity will never be satisfied, but it would be satisfied if once the Navy can say quite distinctly, "Give us so much force and we will guarantee that the enemy's fleets, whatever may be the case with cruisers, will not find their way out." That reminds me of one point that I did not reply to Captain Wilson upon. I admit the escape of cruisers; I say the Federal experience shows us that we cannot keep them in. Properly fitted cruisers will get out, but fleets, squadrons such as we profess to be afraid of, and such as are absolutely necessary to the invasion of this country, may, as my paper will go to show, be absolutely prevented from escaping, provided only that we have a reasonably large naval force armed and prepared for the clear duty which lies before it.

The CHAIRMAN: If I had wished to criticize this very able and intelligent paper I am in a very comfortable position for doing so, because I do not intend to give Admiral Colomb the opportunity of answering. I really have so little to criticize in it that I shall certainly avoid doing so. He commenced with throwing a little doubt on the opinions expressed by the Royal Commission of which I had the honour to be a member in 1859-60, as we had stated in our Report that it appeared an efficient blockade would be almost impossible in future on account of the introduction of steam. It is twenty-seven years since we sent in that Report, and I think I may say that the blockade to which the Commission referred was a commercial, not a military blockade. I rather object to the word "civil," as in any circumstances it is about the most uncivil thing you can inflict on an enemy. I think "commercial" blockade is a better term, I may say that a commercial blockade or the sealing of a port is the most important of all blockades: it includes masking and the blockade of observation. If you can seal the port completely against egress or ingress you include the other blockades that Admiral Colomb has referred to. Twenty-seven years ago I certainly had an idea not only that an efficient blockade could not be maintained in consequence of the ease with which steamers could escape, but it seemed to me very difficult to blockade at all, and I think it was the opinion of a great many naval Officers at that time. I must confess that this paper of Admiral Colomb's being founded on history and actual experience of facts concerning the manner in which blockades have been carried out, or attempted to be carried out in times past by sailing vessels, and which have failed in so many instances, convinces me that a blockade in the present day can be carried out with *almost* the same certainty as it could be in former days, but I have

a strong opinion still that the introduction of steam and the use of torpedo-boats in modern warfare is *of more advantage to the blockaded port than to the blockader*, and that is as much as we can say with certainty. The blockaded ships will be able to take advantage of their clean furnaces and boilers, their clean bottoms, full supply of coal, and their torpedo-boats of greater speed, which will give them an advantage over the blockading squadron. Thus the advantage would be on the side of the blockaded. I fully endorse the few words with which Admiral Colomb concluded his paper, and say that if you wish to ensure the national safety you must keep the command of the sea. There is no question about it, we must keep command of the sea. But however strong we may be at sea by the increase of our fleets, you never can expect the Army or those responsible for the defence of the country to give up fortification of important ports or troops to resist a landing; it is impossible to do that, because there are the contingencies of a dark night and bad weather, under cover of which a blockading squadron may dash through your fleet without your knowing which way it was going. In the old days of sailing ships you knew from the direction of the wind to a great extent which course the ships would probably take and could chase accordingly, but at the present day if a large steam squadron were to get out they may divide and you won't know in what direction they go. Therefore, although I hope we shall insist upon keeping the command of the sea in its fullest sense to meet any Powers likely to be brought against us, we must have our forces at home as well, and fortify our naval ports. I will now ask you to allow me to give your thanks to Admiral Colomb for his most useful and interesting paper.

PLANS OF MOORINGS PROTECTED BY NETTING AGAINST TORPEDO ATTACK, TO BE UTILIZED MORE ESPECIALLY BY A BLOCKADING SQUADRON.¹

By Staff-Commander JESSE DIXON, R.N.

In the event of war with any Power where the base of our blockading operations is at some distance from any of our own possessions, or from the port of an ally, one of the principal objects will be, the getting out of ample supplies of coal, stores, and provisions to the fleet, and when safely got out, to protect them from being destroyed by the enemy; as our fleet, however, will probably be greatly superior to that of the enemy's (and I hope I shall not be considered too sanguine in assuming that in any war England may be engaged in, for many years to come, there would be no doubt of our maritime superiority, and that our Navy will be more powerful than any, and infinitely superior to most other navies), we shall have little to fear except from torpedoes, and perhaps at some future time from submarine boats, and for thus protecting our colliers, store ships, ships undergoing repairs, coaling, &c., and to do away with the expensive, and in many cases dangerous necessity of being continually on the move and under steam,² these or similar plans may be found practicable.

Again, powerful as our Navy may be, it can hardly be strong or

¹ Read at the meeting on the 15th June.

² It was lately stated at this Institution "That in the blockading of an enemy's port it would be necessary to coal ships so engaged, under way, as no blockading squadron, nowadays, could possibly with any safety anchor, but would have to keep continually on the move and under steam."

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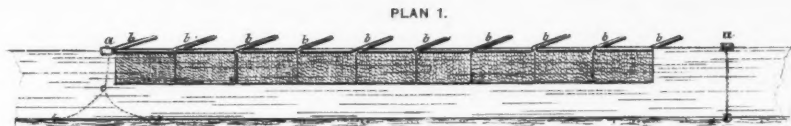
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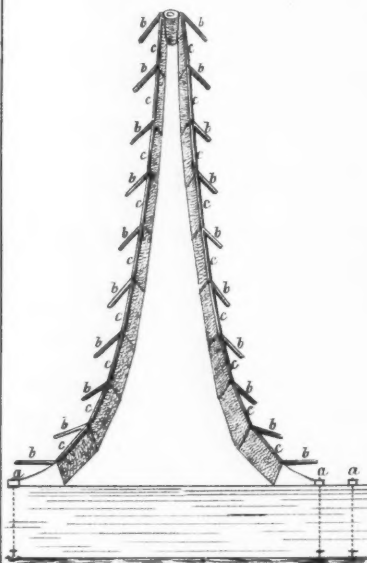
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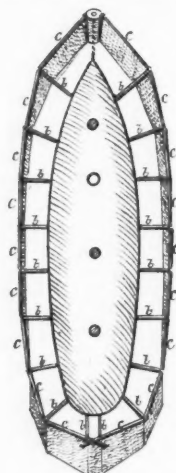
DIAGRAM 1.
MOORINGS WITH NETTING ATTACHED TO AN IRON BAND ROUND THE BUOY.



PLAN 2.
NETTING READY FOR A VESSEL
TO MAKE FAST TO BUOY.



PLAN 3.
VESSEL MADE FAST TO BUOY AND
NETTING HAULED ROUND HER.



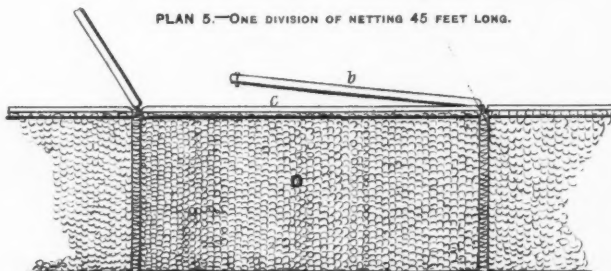
PLAN 4.
MOORINGS NOT IN USE.



Scale $\frac{3}{4}$ of an inch to 100 feet.



PLAN 5.—ONE DIVISION OF NETTING 45 FEET LONG.



Scale 1 inch to 20 feet.

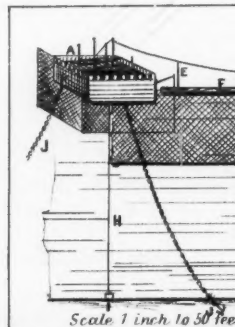
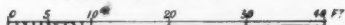


DIAGRAM 2.

COALING HARBOUR $2\frac{1}{2}$ CABLES LONG $1\frac{1}{2}$ WIDE, TO AFFORD PROTECTION TO 2 LARGE COLLIERIES OR STORE SHIPS AND 2 GUN BOATS.

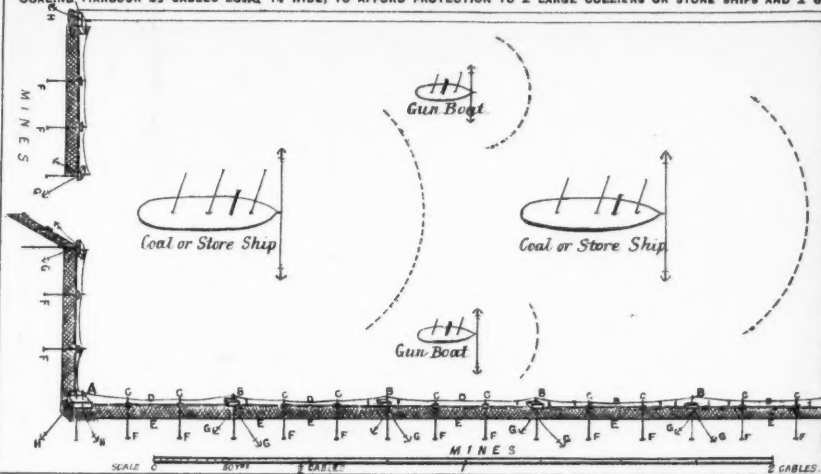


DIAGRAM 3.—PLAN OF COALING HARBOUR 6 CABLES LONG AND $2\frac{1}{2}$ WIDE, TO AFFORD PROTECTION TO 4 COLLIERIES OR STORE SHIPS, 2 IRONCLADS, AND 6 OR 8 SMALL CRAFT, IN A GOOD ANCHORAGE OR ROADSTEAD.

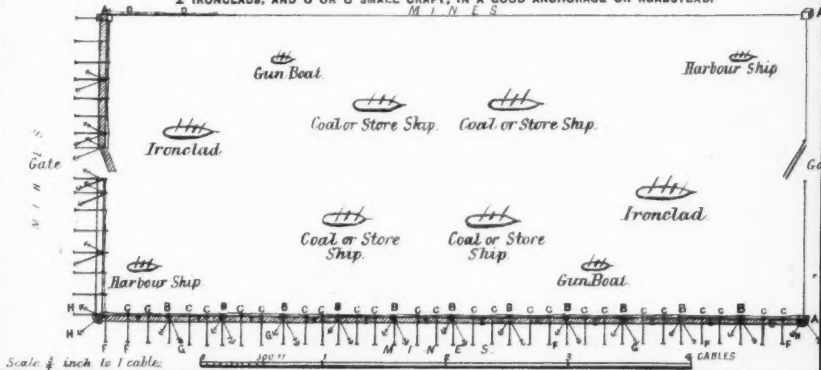


DIAGRAM 4.

SECTION OF HARBOUR, $\frac{1}{2}$ CABLE IN LENGTH.

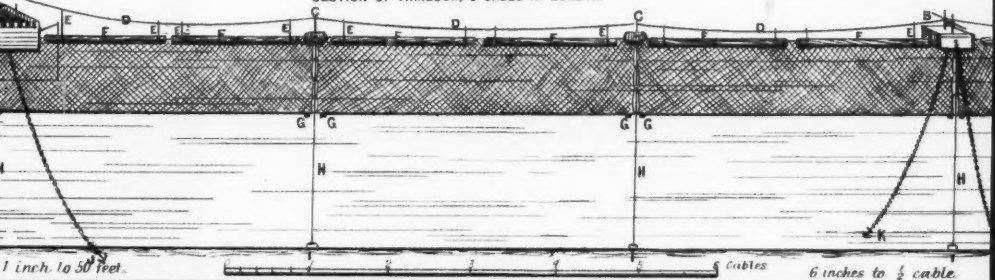
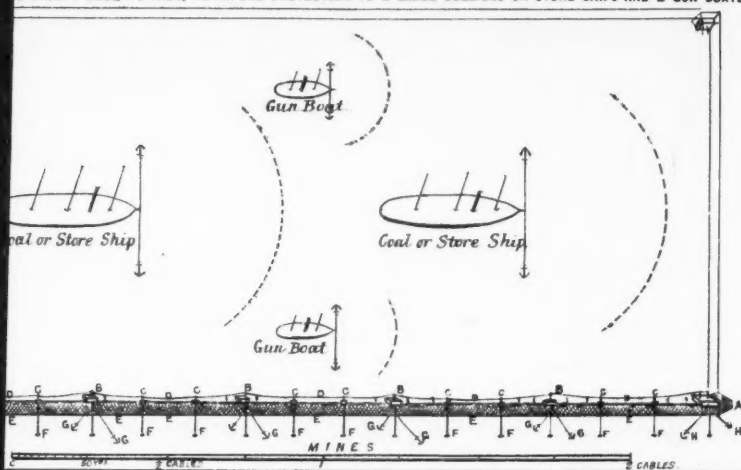


DIAGRAM 2.

2 CABLES LONG 1½ WIDE, TO AFFORD PROTECTION TO 2 LARGE COLLIERIES OR STORE SHIPS AND 2 GUN BOATS.



OF COALING HARBOUR 6 CABLES LONG AND 2½ WIDE, TO AFFORD PROTECTION TO 4 COLLIERIES OR STORE SHIPS, 2 IRONCLADS, AND 6 OR 8 SMALL CRAFT, IN A GOOD ANCHORAGE OR ROADSTEAD.

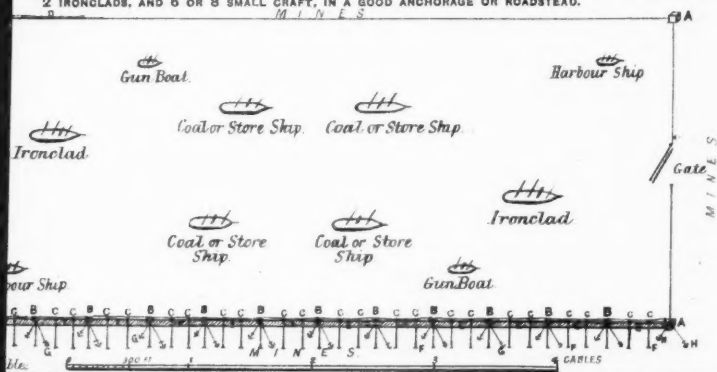


DIAGRAM 4.

SECTION OF HARBOUR, ½ CABLE IN LENGTH.

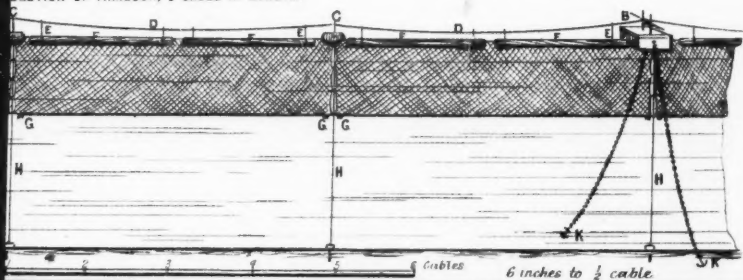


DIAGRAM 5.
PLAN OF ONE DIVISION OF NETTING 100 FEET LONG.

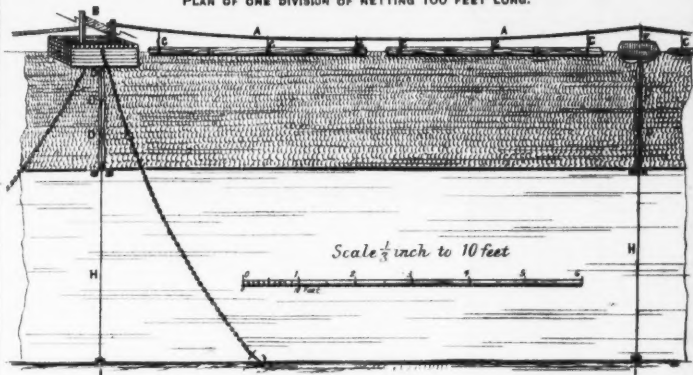
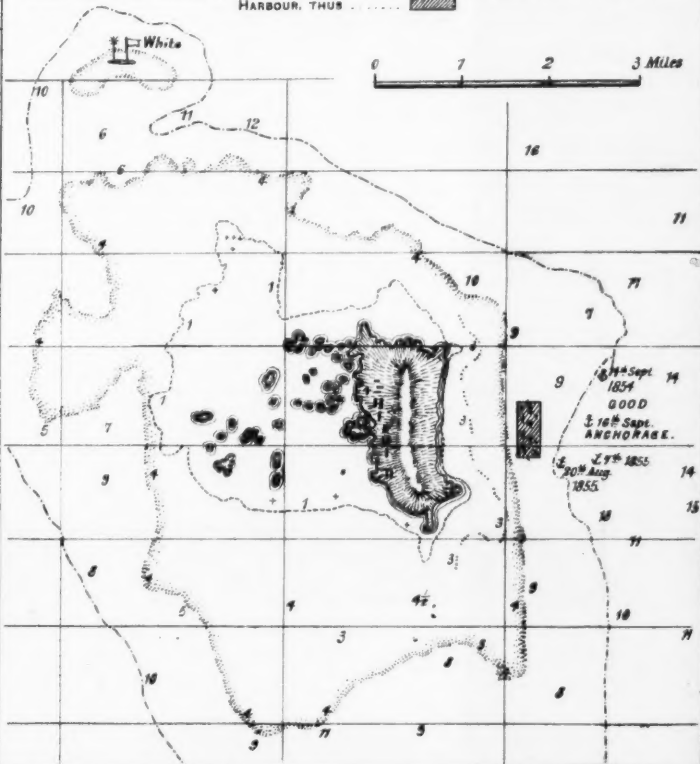


DIAGRAM 6.
CHART OF SESKAR ISLAND, 34 MILES OFF CRONSTADT, SHOWING PROPOSED POSITION OF COALING HARBOUR, THUS



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numerous enough to prevent some of our many Colonial harbours, coaling stations, and even our roadsteads round England, being attacked by torpedo vessels, more especially as many of our Colonial harbours and coaling stations are hardly in a proper state of defence against the attacks of torpedo or any other vessels of war, and I think moorings protected with netting would be found useful auxiliaries in many of these places for protecting shipping from torpedo attacks.

Imagine a blockading fleet composed, say, of twelve ironclads, three or four colliers or store ships, possibly a transport or two, and numerous small craft, keeping continually on the move during a fog, up the Baltic, for instance, a place studded in most parts with rocks or shoals every 4 or 5 miles. I am afraid that in a very short time a good many vessels would have come to grief, and I think most people will agree that colliers, store ships, &c., must anchor, and must be protected from torpedo and submarine attack.

The materials for protected moorings, or for making a coaling harbour, are supposed to be taken out with the fleet in one or more harbour ships or tugs, armed with machine-guns, and specially fitted with appliances for laying down moorings, &c., and capable of being used as tugs.

The locality selected for the harbour should have good holding ground, moderate depth of water (from 5 to 10 fathoms), and should be, if possible (where there is any prevailing wind), to leeward of an island, that the danger of any floating mass directed towards the harbour by the enemy may be lessened; for the same reason, it would be an advantage to have reefs or rocks in the direction the tide or the current runs from. Any floating body, as, for instance, a ship, directed against the harbour should be blown up by mines laid down outside the netting.

Diagram 1 is intended to illustrate the proposed plan of moorings protected by torpedo netting.

Figs. 1, 2, 3, 4 show the moorings with netting attached to an iron band round the buoy, so that a vessel could steam between the two small buoys (*a*),¹ and make fast to the ring of the mooring buoy, casting off the lines at (*a*), and hauling the netting round her, using the small spars (*b*) to shore off the netting.

Fig. 5 represents one division of netting 45 feet long, floated by spars (*c*) 42 feet long, 17 inches diameter, with a floating power of $16\frac{1}{2}$ cwt., fitted with a wire jackstay on its outer side to secure the netting to, with a shackle at one end, and an eyebolt and ring at the other end of the spar, the small spar (*b*) 30 feet long and 8 inches diameter (similar to those at present used with torpedo nets, only smaller) being shackled to the ring.

¹ I have considered several plans for protected moorings, and at present I think there are fewer obstacles to be found in the one shown in Diagram 1 than in any other. One objection is having constantly to shift the small buoys (*a*) every time the wind shifts. (This I believe may be remedied.) Another point to be considered is, whether (in case of a gale of wind) it would not be safer to float the lengths of netting next to the mooring buoy, in some other way, so as not to have two heavy spars knocking about under the bows, should the netting be carried away.

I may add, these moorings might be useful not only for colliers, store ships, transports, &c., but could also be used by men-of-war wishing to slip from their moorings to give chase, &c., without being encumbered or delayed by their own torpedo netting.

Diagram 2 represents a coaling harbour $2\frac{1}{2}$ cables long and $1\frac{1}{4}$ wide to afford protection to two large colliers or store ships and two small craft against the attacks of torpedo or submarine boats. The materials for making the harbour, weighing about 300 tons including spare gear, consist of four large pontoons or stages (A) about 20 feet square and 6 feet deep, to form the corners of the harbour, moored with two 50-cwt. anchors, and fitted with two winches for setting up the netting.

Twelve small pontoons (B) 10 feet square to support the ends of each half-cable, fitted with one winch and moored with two 14-cwt. anchors.

Twenty-eight buoys (C) having a floating power equal to buoys 4 feet square, viz., 1 ton 8 cwt. each.

Seven 5-inch hawsers (D) to connect pontoons and buoys.

Seven hundred and fifty fathoms of wire netting (E) 20 feet deep.

Forty-four sinkers (F) 10 cwt. each, for mooring the buoys.

Twenty-four 14-cwt. anchors (G) for mooring small pontoons.

Eight large anchors (H) for mooring the four corners of harbour.

Eighty-eight small spars (I), 40 feet long, 12 inches diameter, with a floating power of 7 cwt. 3 qrs. each, to support the netting between the buoys.

In the space below the netting (or between the wire netting (E) and the bottom) rope netting with mines attached, and other impediments to be placed (the details of which would take too long to describe in this short paper), and also a system of mines to be laid down outside the harbour to prevent submarine boats getting inside.

Diagram 3 is intended to represent an artificial or coaling harbour to afford protection to four large colliers or store ships, two ironclads, and six or eight small craft, the materials of which would weigh about 600 tons, and is on the same principle as the harbour represented in Diagram 2.

Diagram 4 represents one section of the harbour half-cable in length.

Diagram 5. One division of netting 100 feet long.

Diagram 6 is a chart of Seskar Island, $3\frac{1}{4}$ miles off Cronstadt, a suitable locality for a coaling harbour. In the Baltic there are many places admirably suited for either laying down protected moorings, or making a coaling harbour.

In conclusion, I wish to say I am glad to have had the opportunity of introducing the subject of protected moorings for your consideration. The principle of building an artificial harbour off an enemy's coast by a blockading force may be found practicable on some future occasion to afford protection to vessels whilst taking in coals or stores.

EXPLANATION OF THE DIAGRAMS.

DIAGRAM 1.

- a. Two small buoys for keeping the torpedo nets apart, moored with small anchors.
- b. Eighteen small spars, 30 feet long, 8 inches diameter (similar to the ones at present used with torpedo netting), to be secured to chains, or where most convenient to shore off the netting, and shackled to ring of larger spars (C).
- C. Eighteen spars, 42 feet long, 17 inches diameter, with a floating power of 16½ cwt. each, fitted with a wire jackstay on its outer side to secure netting, and fitted with eyebolt and ring at one end and shackled at the other.
- D. Wire netting similar to that at present in use.

Plans 1, 2, 3, 4.—Moorings, with netting attached to an iron band round the buoy, so that a vessel could steam between the two small buoys (a), and make fast to ring of mooring buoy, casting off the lines at (a), and hauling the netting round her, using the small spars (b) to shore off the netting.

These moorings might be useful, not only for colliers, store ships, transports, &c., but could also be used by men-of-war wishing to slip from their moorings to give chase, &c., without being encumbered or delayed by their own torpedo netting.

Moorings at coaling stations and at man-of-war anchorages could be thus protected from torpedo attack with little expense.

If thought necessary some obstruction could be placed so as to prevent a torpedo being fired over the spars.

DIAGRAM 2.

Materials for a Coaling Harbour 2½ cables long and 1½ wide, to be taken out in two harbour ships or tugs, accompanying the Fleet.

	Weight. tons cwt. qr.		
A. Four large pontoons or stages, about 20 feet square and 6 feet deep (to be taken out in pieces), forming the four corners of the harbour, and fitted with two winches	40	0	0
B. Twelve small pontoons, about 10 feet square and 4 feet deep (to be taken out in pieces), fitted with one winch and davit for wire hawser to reeve through	23	0	0
C. Twenty-eight buoys, 4 feet square, having a floating power of 1 ton 8 cwt. each	10	10	0
D. Seven 5-inch wire hawsers, to connect pontoon and buoys, being 8 feet above the netting at the pontoons and 4 feet above at the buoys	9	0	0
E. 750 fathoms of wire netting, 20 feet deep	54	6	0
F. Forty-four sinkers, 10 cwt. each, for mooring buoys, and attached to 4-inch wire ropes, down which the netting travels	22	0	0
G. Twenty-four 14-cwt. anchors for mooring intermediate pontoons. Small chain	16	16	0
	6	10	0
H. Eight large anchors for mooring the four corners of harbour (50 cwt.)	20	0	0
Twenty shackles, 1½ chain	13	10	0
I. Eighty-eight small spars, 40 feet long, 12 inches diameter, with a floating power of 7 cwt. 3 qrs. each	45	0	0
	260	12	0

DIAGRAM 3.

Materials for an Artificial or Coaling Harbour, 6 cables long and $2\frac{1}{2}$ wide, to be taken out in two harbour ships or tugs, accompanying the Fleet.

	Weight.			
	tons.	cwt.	qrs.	lbs.
A. Four large pontoons or stages, about 20 feet square and 6 feet deep (to be taken out in pieces), and forming the four corners of the harbour, and fitted with two winches each	40	0	0	0
B. Thirty-four small pontoons, about 10 feet square, 4 feet deep (to be taken out in pieces), fitted with one winch each, and davit 6 feet high for wire hawser.....	68	0	0	0
C. Sixty-four buoys, each with a floating power equal to that of a buoy 4 feet square, viz., 1 ton 8 cwt., with a staff and fairleader on top for 5-inch hawser to reeve through, the staff 3 feet high	24	0	0	0
D. Fourteen 5-inch wire hawsers to connect pontoons and buoys, being 8 feet above the netting from the pontoons, and 4 feet above at the buoys.....	17	17	0	0
E. 1,700 fathoms of wire netting, 20 feet deep.....	122	19	0	0
212 weights attached to netting, weighing 20 lbs. each....	1	17	3	12
F. 106 sinkers, 10 cwt. each, for mooring buoys, and attached to 4-inch wire ropes, down which the netting travels, when necessary to lower it	53	0	0	0
G. Sixty-eight 14-cwt. anchors for mooring intermediate pontoons	47	12	0	0
H. Eight large anchors, about 50 cwt. each, for mooring the four corners of harbour.....	20	0	0	0
Twenty shackles, $1\frac{1}{2}$ -inch chain cable for mooring large pontoons	13	10	0	0
I. 200 small spars, 40 feet long and 12 inch diameter, with a floating power of 7 cwt. 3 qrs. each	101	15	0	0
	510	10	3	12

DIAGRAM 4.

- A. Large pontoon or stage, about 20 feet square, to be taken out in pieces, fitted with two winches, &c., and forming the corner of the harbour.
- B. Intermediate pontoon or stage, 10 feet square, fitted with one winch.
- C. Buoys, with a floating power of 1 ton 8 cwt. each, equal to a buoy 4 feet square.
- D. 5-inch wire hawser.
- E. Slips or lashings (hemp) for connecting netting to wire hawser.
- F. Small spars, 40 feet long, 12-inch diameter, which could be supplemented by cross-pieces, or other impediments if thought necessary.
- G. Weights about 20 lbs. each.
- H. 4-inch wire rope for mooring buoys and for netting to travel down where it is found necessary to sink it to the bottom.
- I. Sinkers, 10 cwt. each.
- J. 50-cwt. anchors and cable for mooring corner pontoon.
- K. 14-cwt. anchors for mooring intermediate pontoons.

DIAGRAM 5.

- A. 5-inch wire hawser for connecting buoys, and assisting to suspend netting.
- B. Winch on pontoon for setting up hawsers and netting.
- C. Slips or lashings for securing spars and netting to hawser; which would have to be slipped or cut before netting could be lowered.
- D. Travellers to run down 4-inch wire rope, when it is required to lower netting.
- E. Buoy, with a floating power equal to that of a buoy 4 feet square, viz., 1 ton 8 cwt.
- F. Block with rope, for lowering and hoisting up netting.
- G.¹ Spars about 40 feet long, and 12-inch diameter; two having a floating power of 15 cwt. 2 qrs.
- H. 4-inch wire rope, attached to sinkers I, 10 cwt. each.

	tons	cwt.	qrs.
Floating power of two spars.....	0	15	2
Floating power of buoy.....	1	8	0
	2	3	2
	tons	cwt.	qrs.
Weight of 100 feet of netting.....	1	4	0
Two weights.....	0	0	2
Travellers and 4-inch rope (under).....	0	1	0
	1	5	2

As the floating power is 2 tons 3 cwt. 2 qrs., and the weight 1 ton 5 cwt. 2 qrs., there will be very little downward pull on 5-inch hawser.

DIAGRAM 6.

Seskar is a low sandy island, covered mostly with fir trees; it lies in latitude 60° 2' N., and longitude 28° 17' E., about 34 miles from Cronstadt. The anchorage on the east side of the island is very good, with capital holding ground, and was constantly resorted to by the English Fleet in 1854 and 1855. In those years there were about eighty inhabitants besides children; they lived chiefly on fish and milk.

The thanks of the Meeting were voted to Staff-Commander Dixon for his suggestive paper.

¹ If considered necessary, cross-spars or other impediments could be lashed on the spars to prevent boats jumping them; but as each side of the harbour would be covered by machine and other guns at only a hundred or a few hundred yards distance, a torpedo-boat would be almost as certain to be sunk or disabled as if she tried to jump the netting round a ship.

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SUGGESTED IMPROVEMENTS IN CHART TABLES.

By Lieutenant JOHN MARX, R.N.

THE chart tables, as at present supplied to the smaller classes of H.M. ships which are without chart houses, are the source of much annoyance. They leak in wet weather, and are thus the cause of many charts being spoilt, an important matter when on a long cruise, in intricate navigation on distant stations, where charts cannot be replaced. At night the table is generally lighted by a ship's lantern, the bottom of which is not always clean, and which when the ship is rolling is apt to upset, and then the grease running over the chart does not improve it, to say nothing of the fact that the table on a bridge is generally the handiest place to put down a sextant or a cup of cocoa for a minute; these and other small things thoughtlessly placed on it soon tend to make a chart illegible. Even fair wear and tear soon spoil a chart, the pencil marks of previous days have to be erased, and in doing this, the finer markings of the chart are apt to be rubbed off.

Hands and instruments are often unavoidably not as dry and clean as they should be, and a great object would be gained if all the pencil marks and other work could be done on a transparent surface laid on and fitting close down to the chart. Such a surface can be obtained by laying a large sheet of ground glass fitted in flush with the upper edge of a strong wooden frame, and kept in its place by metal clamps at the corners, thus allowing the rulers a chance of working over the edges without being continually shifted. The surface on which the chart is laid must be flat, so as to allow the glass to rest evenly on it, this can be secured by making the table after the fashion of a drawing board with strong battens at the back to prevent warping. The wet can be kept out by bringing the edges of the frame holding the ground glass, well below the surface of the table on which the chart rests. A stout wooden cover hinged on at the back to protect the glass when not in use, and a drawer underneath for the safe custody of the instruments, would complete a useful form of chart table calculated to prolong the life of the charts, and to save the navigating Officer much trouble when working in the rain or near the side of his chart.

OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

NAVAL REFORM.¹

M. GABRIEL CHARMES had not, I believe, specially devoted himself to naval questions before he wrote the article which forms the first chapter of this book, in the "*Revue des deux Mondes*" for December, 1884. He was a great writer of articles of a varied character, and being essentially a literary man, does not appear to have been exceptionally qualified for the task he undertook in the production of the book of which that under review is a very successful translation. The importance of the work rests less upon its authorship than on its being the literary exponent of a school of naval policy of which Admiral Aube has become the acknowledged head. When the French Admiralty, after designing a new type of war vessel which embodies to a greater or less extent the principles advocated by our author, christened her the "*Gabriel Charmes*," they stamped those principles with an official imprimatur, and admitted the weight of the writer who embodied them in their published form. So the book is in some sort a barometer by which to gauge possible French naval opinion, and to forecast French naval action. As such it demands our careful study, and as it really traverses the whole ground of naval policy not only for France, but for all naval nations, it offers everywhere contentious matter, very suitable to bring out truth in argument and discussion.

The book has the fault of too many French naval writings in mistaking strength of assertion for verification of fact. There is nothing in it of the humble tone of the doubtful but persevering inquirer; it is full of the confidence of one who knows, and is somewhat irritated by the want of comprehension displayed by possible disciples. Hence to an Englishman, accustomed to feel himself disentangling a provokingly difficult skein, in following the evolutions of the gun, the ram, the torpedo; iron plating and steel protection; 10,000-ton ships, torpedo vessels, gun- and torpedo-boats; search; lights water pressures and air pressures; the Gordian method of M. Charmes does not always commend itself.

The book consists of five chapters, of which the first three appeared in the

¹ "*Naval Reform*." From the French of the late M. Gabriel Charmes. Translated by J. E. Gordon-Cumming. London: Allen & Co., 1887. Pp. 256. Size 9" x 5" x 14". Weight under 1 lb. 10 ozs. Price 12s.

columns of the "Revue des deux Mondes." These are entitled: I. "Torpedo and Gun-boats;" II. "Naval Warfare and the Organization of Naval Forces;" III. "Coast Defence;" IV. "Naval Personnel;" V. "Service Afloat." There are some interesting appendices; one a defence of the "Gabriel Charmes" type of gunboat; a second and third dealing with the Maritime Inscription; a fourth drawing particular lessons from an accident on board the "La Clocheterie;" and a fifth offering a very hostile criticism on the state of the French Navy in the year 1885. This sort of criticism is frequent throughout the book, and should be so far a comfort to our own critics, and perhaps a plausible answer for those who, being the subjects of criticism in England, have no other replies at hand.

M. Charmes cannot be properly understood, nor the intrinsic value of his words duly estimated, unless we have mastered the principles which animate the thoughts of M. Aube, of him without whom the book would hardly have seen the light.

M. Aube put forth his views of future naval warfare, and policy of preparation therefor, in an article in the "Revue des deux Mondes" for 1st July, 1874, and he repeated these views with emphasis, but without adding materially to the strength of their basis, in an issue of the same periodical for 15th March, 1882. As M. Charmes' writings are almost a natural enlargement and development of these two articles, it is only reasonable to suppose that though the hands are those of Esau, yet the voice is that of Jacob. Admiral Aube's is a well-known name in England, and the objective which he puts before the French nation—our coast towns and commerce—in the event of its going to war with us, is generally known, however imperfectly we may be supposed to have apprehended the consequences. But though this much is known, I am not sure that anyone has as yet offered a full criticism, either of M. Aube's views or of the process by which he has reached them. In now attempting to fulfil this duty I shall offer, I think, a clue to M. Charmes' ideas, which, if we carry it with us in reading his book, will materially assist in weighing the real capabilities of his proposals.

M. Aube starts with one far-reaching principle, which may be true, but which I do not think he can be said to have established by the facts he adduces in support of it. It is a principle which ought to be comforting and reassuring to this nation, because it condemns as chimerical our cherished fears not only of invasion, but of organized attacks of any kind on any part of our territories by any naval nation. In M. Aube's steadfast opinion, marked superiority in ironclad fleet-ships makes naval war, such as it has been in the past, impossible. The State which has the command of the sea to the extent of being able to offer battle on equal terms to any ironclad fleet of the enemy, and still to possess a reserve of the same sort of force, will, by the simple exhibition of her powers in this way, cause the enemy to keep his fleets sealed up in his ports. It is very necessary to bear in mind that when M. Aube speaks of the command of the sea, he means to go no further than ironclad fleets, and consequently organized expeditions by sea.

Speaking of us, he says:—

"Supremacy at sea, the empire of the sea (which was disputed no more with England after the Nile and Trafalgar), belongs to her for ever; we have shown besides that they come to that nation which has the greater number of ironclads, and the English fleet is without a rival; but if these phrases have remained the same, how different are the ideas which such words convey!"

To most Englishmen, the words "supremacy at sea" and "the empire of the sea" convey precisely the same meaning in 1887 which they conveyed in 1807. We believe that if the main fleets of France were not strong enough to come out to sea and meet ours with reasonable hopes of success in 1807, a certain condition of things was established which we called "the empire of

the sea." Were we now to go to war with France in the belief that her ironclad fleets would remain throughout the war in their harbours, we should look to an "empire of the sea" not greatly differing from what we found it eighty years ago.

But to M. Aube such a belief appears absurd. In effect he says that France, if she accepts his policy, will yield us the empire of the sea, never attempting to molest our fleets on the ocean, because she will be conscious that this empire is a myth—a robe of empty glory, granted to us but to conceal the dagger which is to strike us to the heart.

M. Aube's belief that the French ironclad fleets will rest in their harbours seems to rest more on illustration than on proof. He has seen that the Russian fleets in 1854-55, the German fleets in 1870, and the Russian fleets again in 1877, all remained in their ports in face of the superior fleets of England and France, of France, and of Turkey. Analogy alone, so far, would lead him to believe that France in a war with England would follow these examples. But analogy is incomplete, for the main forces of Austro-Prussia and Denmark, of Italy and Austria, and of Chili and Peru, all fought it out on the open sea. In the case of Austria and Italy, the former was distinctly inferior in ironclad force, and yet she risked and won a battle at sea. Thinking as the ordinary Englishman does, he could not exclude from the argument those analogies which seem to make against the conclusion, as Admiral Aube certainly appears to do. We cannot base any analogy tending to assure us that the French ironclads will not try to concentrate and beat ours at sea, on the facts that the Germans did not so act against the French, nor the Russians against the Turks, while the Austrians did so act against the Italians. Analogy would rather tell us that if the next naval war is to be Anglo-French, there will be an ironclad battle.

But the arguments of M. Aube, other than analogies, are complex, far-reaching, and difficult to state with clearness, and to balance with accuracy. The immediate conclusion on which he decides that French ironclad squadrons will not put to sea against the English is, that whatever the nationality, the most numerous ironclad squadron will win. As a fact, in the one case where the thing was brought to an experimental trial, the most numerous squadron lost, as poor Persano found to his cost.

A curious subsidiary argument, found below this claim on behalf of the modern ironclad fleet, is that the conclusion stated is the proof that the modern ironclad is not a permanent type. Here are his words:—

"Because of the individual equality of the elements constituting two hostile ironclad squadrons, the victory is assured to the most numerous of the two, of which the reserve will not come into action until after the first phases of the fight, the ramming attack leading up to the *mêlée*."

But then, as the logical sequence of this state of things is the disappearance of naval war, it follows that—

"If the ironclad fleet-ship in opposition to every other class of ship has perhaps a real superiority over her adversary, she is not the true expression of the fighting unit vainly sought for up to the present day."

But putting aside this subsidiary question, we have before us the practical statement of opinion that as long as both nations continue to produce ironclads, using guns, torpedoes, and rams as their weapons, (1) the French ironclads, by reason of their inferior numbers, will remain in their ports; and (2) this will happen because it is certain that the more numerous ironclad squadron will beat the less numerous in action.

Working down the chain of argument and leaving on one side the great fact that the single experiment which has been tried is all against this conclusion, we have to ask, why does it follow that the most numerous ironclad squadron will win?

It follows according to M. Aube from the inevitable character of the ironclad sea fight. But the English mind will immediately ask, why inevitable? What is the proof that the form of ironclad battle should be a fixed one? It seems strange to the English intelligence that the dicta of a few French Officers and one Russian should be accounted sufficient proof, and yet the French Admiral seems to think it so. Jurien de la Gravière, I think, was the author of the phrase "the establishment of the *mêlée*," and French naval writers seem almost unanimous in regarding "the *mêlée*" as a legitimate phase of modern naval battle. A little time ago English naval Officers, caught by the phrase, accepted it to such an extent as to assume that "the study of naval tactics" was a contradiction in terms. There was no such thing as naval tactics—it was a mere matter of *mêlée* whatever plans might have been formed, and therefore all plans were useless. Slowly in the English Navy this *laissez aller* conception is passing away, and men are beginning to see that *prima facie* the case is entirely the other way. If, as M. Aube admits, sailing fleets presented to our great Admirals powers of combination and concentration, of which they availed themselves, does it not follow that greater powers of locomotion, and greater speed in the individual ships, will not offer still greater opportunities of the same kind? English Officers are getting out of the habit of mixing up the gun, the ram, and the torpedo, as though they were weapons on the same level; and they have a more present recollection that the ram does not influence an action fought at a minimum distance of 600 yards; and that the torpedo does not influence one fought at a minimum distance of 1,000 yards. Before the *mêlée* can be accepted as a certain phase of all naval fleet actions in the future, the English mind will require to be shown, either that every Admiral of every nationality will determine to bring the ram into action under conditions which give him no advantage from its use; or else that any one Admiral has the power of forcing the ram battle upon any other against his will. It has become accepted by the English naval mind that more than ever victory will depend on the superior handling of the fleet.

The Battle of Lissa, the one experiment tending to show that the *mêlée* is an inevitable phase of the ironclad fleet action, may be as easily, if not more correctly, read to argue otherwise. Truly there was a *mêlée* present there, but truly one of the two fleets was absolutely passive and out of command. Who is to say that Persano would either have sought or permitted a *mêlée* which turned out so badly for him, had he formed a plan and carried it out? And then what happened immediately after this *mêlée* was established? By a sort of instinct the ships of each fleet concluded that that was not the way to fight, and drew apart in restored symmetry and order.

But M. Aube does not think it necessary to consider these things. It suffices him, as I have said, to put on record the opinion of one or two of his countrymen and of one Russian Officer, and to accept them as experimentally determined facts on which a whole policy may base itself. He asks, What will be the future of the naval battle with ironclads of the present character—ironclads which are intended to use independently the gun, the ram, and the torpedo?

"Without doubt after the first encounter with the ram, a passing side by side (*passé d'armes*), a general *mêlée*, such as imagination represents the tournaments of the Middle Ages, but with gigantic proportions, and where the spur takes the place of the knight's lance, the monster gun the mace, where the torpedo will be the dagger of the wretch who shall give the *coup de grâce* and send the conquered to the bottom of the sea—a confused *mêlée* where each combatant will be valued for what she is by her speed, her turning powers, her armour, her guns, by the coolness and grasp of her Captain, but in which the unknown effects of shock, of gunfire, and of torpedo—in one

word—the material element may neutralize the wisest plans, even the genius of the Admiral. You doubt whether this is so? Listen to what those have written who have given their patient attention to eliminate the unknown quantities from the mysterious formula. ‘Is naval tactics a science to-day, does it merit the title?’ asks Lieutenant Semechkin, the aide-de-camp, the devoted follower of the Russian Admiral Boutakov; ‘it is a science *because it must be studied*; but the science does not correspond with the ideas which the word awakens; it will never lose its speculative character, it will never resemble those branches of human knowledge which are founded on dry principles and on well-determined rules.’ Admiral Bourgois, in one of his ablest memoirs, has been led to study the Battle of Lissa; this is the judgment he pronounces:—‘We add nothing to what has been said on the fault committed by the Italian squadron in forming line of battle, nor on the merits of the order adopted by the Austrians; but we say with entire conviction that none of these circumstances, not even the valorous signal to rush upon the enemy and sink him, exercised an appreciable influence over the result of the day. Did not the Austrian squadron pass through the Italian line without hurting it, and had not every vestige of the original formations disappeared when the decisive event occurred—the grand experiment of the ram, the success of which constituted nearly the whole victory of Lissa, and which has immortalized the name of Tegethoff? Like Nelson at Trafalgar, he triumphed more by the energetic audacity of his Captains than by the wise combination of the tactician. No one will dare to count in future combats on the happy chance which delivered up the “Re d’Italia” without direction and perhaps without speed to the determined blow of the “Max;” but we have tried to show in this paper that the skill and the grasp of the Captain, aided by precise knowledge of the manœuvring powers of his ship and the faults of his adversary, may, by creating circumstances not less favourable, provide him with the occasion of as great a success.’

“In the work of one of our naval Officers, who seeks for new rules of naval tactics, we discover avowals entirely similar. For him, between two ships of nearly equal speeds, the issue will depend above all on the coolness and skill of the Captains. In the case of a fleet-action, says the same author:—

“‘We do not know how, on the subject of the order proper for giving and receiving the ramming attack, to propose any absolute rule, for the Admiral must always be inspired by the exigencies of the moment, and subordinate the formation of his vessels to the manœuvres and the nature of the order adopted by those whom he must encounter.’

“Thus,” continues Admiral Aube, “in the absence of fixed rules, the energetic audacity of the Captain insures success better than the able combinations of the tactician; all vestige of the original formations disappears in the *mêlée* after the first shock—a happy chance becomes the decisive event of the day—audacity, coolness, grasp, on the part of the Captain—that is to say, moral qualities which are least fixed, most variable, and least appreciable—the unexpected, in fact. Luck is the last word that naval tactics has to say for itself to-day, that science which once had principles, and therefore fixed rules.”

It is not easy to admit that these statements and quotations form any satisfactory proof of the conclusion arrived at. The quotation from Admiral Bourgois appears to misapprehend the tactics of Nelson; and the idea that the rules under which naval actions were fought under sail were based on tactical principles is hardly borne out by the historical record. That English fleets until the time of Nelson fought under stringent rules which an Admiral might be censured for breaking, is true enough. But the great breaker of these rules was Lord Nelson himself, and he broke them because he had seen that they were wanting in tactical value. M. Aube’s whole theory is there-

fore founded on a misapprehension. If he had said that Lord Howe or Admiral Duncan in their methods of attack trusted to the "energetic audacity" of each of their Captains, he would have been nearer the truth. But both at the Nile and Trafalgar it was essentially the method of attack which made the victories so complete. It was that in both cases Nelson threw the whole of his fleet on a part of the enemy's which gave him decisive control over the battle. And few who have studied the matter closely can doubt that some great genius of like powers will arise to show how the increased locomotive power of steam will increase tactical facilities, and enable the less numerous fleet to beat the more numerous by superior skill in handling.

But, rightly or wrongly, it is thus M. Aube argues, repeating in 1882 the data offered in 1874, and reiterating thereon the dogmatic assertion that, so far as ironclads go, the nation possessing the smaller number will not only keep them in port throughout the war, but will not attempt by the strategical combinations so common to France and Spain in times gone by, to make the ironclad fleet which is inferior in total force, so locally superior that battle may be offered with certainty of success.

M. Aube is confirmed in his view by the example of the United States. Omitting all those cogent, plain, and familiar reasons which have prevented the United States from constructing a sea-going ironclad navy—ignoring the fact that it was by ironclads that the command of the sea was gained and kept in the Civil War—M. Aube assumes, without offering any evidence, that the cause is the adoption of a definite policy as against England, the same which M. Aube presses on the attention of France. With what seems strange want of political insight, M. Aube claims that what caused England to submit to the Geneva arbitration was the fear of a declaration of war by the United States—a fear that the naval policy of America in such a war would have been fatal to the British Empire.

What is this policy thus supposed to be entertained by the United States, and pressed on the attention of France? It is the *guerre de course*.

Broadly it may be stated thus. It is established that the nation weaker in ironclads—or perhaps in main fleets even, if the ironclad should pass away—will not attempt to dispute by any overt act the empire of the sea, and will submit to her main fleets being "nailed up" in their ports by the main fleets of the superior sea Power. This, it is held, is nothing; it will not weaken the inferior sea Power in the least; for while the superior sea Power is entirely competent to prevent the issue of fleets or squadrons from the blockaded ports, it is wholly incompetent even to interfere with the free egress and ingress of fast steamers one at a time. M. Aube considers that he has demonstrated:—

"The powerlessness of a victorious navy to maintain an effective blockade of the enemy's coast, and consequently to protect the national commerce against the pirates *whose speed makes them unapproachable (insaisissable)*."

The inferior sea Power, therefore, devotes the whole of its energies to a war of chasing—to doing on the largest possible scale what the Confederate States did on a small scale—to covering the waters with clouds of fast steam cruizers, who shall, individually and without concert, devote themselves to destroying the property of the enemy, however it can be got at, whether afloat or ashore.

M. Aube has no sympathy with those who preach the immunity of private property in war. War is war, and "may be defined as the ultimate appeal of the right against the force which denies the right;" its object is "to do the greatest possible harm to the enemy," and as riches are the sinews of war, "everything which gets at the sources of these riches becomes not only legitimate, but obligatory." Therefore the bombardment of coast towns, the

holding them to ransom by threat of shelling, is as legitimate as the capture of merchant ships, or rather the destruction of merchant ships, for the making of prizes for purposes of profit must be given up as a consequence of the blockade which is part of the hypothesis.

M. Aube has no doubt about the ease with which this policy can be carried out, but it is curious to notice that he assumes that the inferior sea Power will have the fastest ships! It is not uncommon in speculations as to the future of naval war to see this attitude of mind assumed. One man will have for his plan the heaviest guns, another the thickest plating, another the hardest stem, and M. Aube the fastest ships. It need hardly be said that superiority in any material entity cannot be assumed in naval strategy or tactics. The assumption must always be at least material equality, if it be not better and safer to assume a material inferiority for the study of a tactical or strategical problem. M. Aube cannot obtain the superior speed for his "corsaires," though he may force his enemy to face the same difficulties as he will meet with himself in his efforts.

We have now arrived at this stage in the development of M. Aube's proposed policy. His main fleets are blocked in his ports, and attempted blockade to a further extent fails so completely that the sea is covered with his fast steam cruisers, striking terror into coast towns, and annihilating the commerce of the superior sea Power.

We have to investigate the grounds on which it is assumed that while the primary blockade will be so entirely successful, the secondary blockade will so wholly fail.

The proof is offered in the example of the "Alabama" and her sisters, confirmed by that of the "Augusta" in the Franco-German War, and in the operations of the special blockade runners during the American Civil War. As two things have to be established, the power of breach of blockade, and the power of unchecked depredation afterwards, we may conveniently take breach of blockade first. From what has been already said it will not be expected that M. Aube will be found to go very closely into the proof. And indeed while the assumption is that the "Alabama" and her sisters prove both wings of the case, it is omitted that the Confederate cruisers did not in all cases set out on their travels by breach of blockade, and that the most successful of them, the "Alabama" herself, never saw a Confederate port. Special instances, not mentioned by M. Aube, may unquestionably be produced in favour of the argument, such, for example, as that of the "Sumter," which ran the blockade outwards from the Mississippi in 1861, and that of the "Florida," which ran the blockade of Mobile inwards by means of a ruse, and outwards in darkness. But in fair argument it would be open to anyone to take up the opposite ground to M. Aube, and to maintain that the very small amount of blockade running which was done by armed cruisers would rather show its difficulty than its facility.

But undoubtedly the amount of blockade running at two particular ports, out of near 200 blockaded, was very considerable, and shows that under certain conditions, ships specially prepared for it, may often defy the closest blockade under steam. Yet we ought not to forget, as M. Aube does, that blockade running was soon found to be impracticable except at the ports of Charleston and Wilmington, and that success seemed to rest on the establishment of bases at Bermuda and Nassau. The blockade running was done inwards, not after a cruise in the open sea with a diminished coal supply and a doubtful landfall, but from and to certain ports, one 500 and the other 700 miles from the blockaded port. It may be that the ports of Nassau and Bermuda had a less influence on the success of the running than they appear to have had, but when we are establishing a naval policy on what has taken place formerly, it is necessary to take all the facts into account. Then in the

case of the German cruiser "Augusta," though she is quoted as a case in point, it is not shown that she ran the blockade anywhere.

Fair and unprejudiced argument will very likely go as far with M. Aube as to say that a good deal of independent blockade running by single ships may always be calculated on by the superior sea Power carrying out the blockade; but then there will be many failures, and many intending runners both outward and inward will be captured or destroyed. If a nation like England, fairly warned as she is, chooses to omit all precautions and so to find herself in the position as regards powers of blockade which the Northern States suffered under, then she may fairly anticipate the success of M. Aube's operations against her. But if in peace-time she definitely prepares for work which she will certainly have to do, it may on the face of things be supposed that the work will be reasonably well done.

But assuming the failure of the superior sea Power to enforce blockade, we have next to look for proof that the escaped cruisers will be free to do infinite damage to her towns and shipping. We may fairly answer that they certainly will have just as free a hand as the superior sea Power chooses to allow them. If the escaped cruiser knows that at such a point where shipping are thick, or off such a town exposed to shell fire, she is safe from molestation for several hours, she knows she is free to do an exceedingly good business, and by the same powers she had acquired of breaking the blockade outwards, she may break it again inwards with such portable property as she may have been able to acquire at sea. This is a distinct policy thus threatened against England by France in case of war, and recommended by France to all nations inferior to herself in ironclad power. It is a policy quite distinct from that of the Confederate cruisers, who operated at great distances from home and trusted to neutral ports for the maintenance of supplies, abandoning therefore all idea of attack on, or holding to ransom, of coast towns.

M. Aube gives us the example of the "Augusta," and it is of the oddest character, inasmuch as the unwary would certainly read it as upsetting M. Aube's theories entirely. The "Augusta" was a German man-of-war of good speed, a sister vessel to the "Union," which did such service in the Chilo-Peruvian War. At a time when the German ports were closely invested by the French, she suddenly appeared off Rochefort and captured a little Government despatch boat; a few hours later she was off the mouth of the Gironde and had captured a couple of merchant ships which had already considered themselves to have made their port. Then she was off no one knew where. Two French men-of-war presently found her at Vigo short of coal, and they lay there watching her till the war was over. M. Aube is amusing over the "Augusta," for while admitting the shortness of coal which drove her into Vigo, he claims that it would have been otherwise had her Captain possessed the spirit of a Semmes or a Wadell. At the moment he could hardly have recollected that Semmes had to sell his ship at Gibraltar on account of this same coal question. It is probably impossible to say that this experiment was regarded in Germany as very hopeful towards its repetition.

The wider experience of the Confederate cruisers is taken by M. Aube in the general case. He goes not beyond the fact, in his enquiry, that the "Alabama" and her sisters were the ruin of the American carrying trade. If we could stop there, we might be obliged to accept his whole case, but when we remember that most of the "Alabama's" prizes were sailing vessels, and that she captured them while under sail herself, we observe that not alone steam and superior speed had to do with the success of this *guerre de course*. A number of other things, and notably the entire unpreparedness of the Federals, must be taken into the account.

But on the whole question taken in full light and in its broad bearings, M. Aube is demonstrably in error. He is constantly contrasting the absoluteness

of the empire of the seas enjoyed by England after the battle of Trafalgar, the completeness of her blockades, and the freedom of her commerce from interference, with the hollowness of the same empire in a modern naval war. Her powers of close blockade no longer exist, and her ships will be everywhere the prey of her otherwise weak adversary. But when the American historian, Professor Soley, begins to narrate the proceedings of the Federal Navy, the first thing that strikes him is to contrast the extreme looseness and inefficiency of the best blockade in the days of sailing ships with that wonderful and almost complete sealing up of ports which his countrymen were able to carry out with the aid of steam propulsion. How little difficulty there is in deciding in favour of the right judgment of the American author, may be seen from one or two of the following facts.

Taking at random the months of October and November, 1810, and turning to the "Naval Chronicle" for that period, we find:—In the first place, extracts from the "Gazette" report the capture of no less than thirty-eight privateers in the Channel and North Sea. In October the "Naval Chronicle" wrote as follows:—

"Our letters on service announce, in the usual concise style of the Admiralty, the capture of a number of the enemy's privateers, but do not, or cannot account for, our own much greater and more sensible losses in merchant vessels. In fact it appears from the coast correspondence that at Dover 'signals are out almost every day on account of the enemy's privateers appearing in sight.'

"We have more than once referred to this very surprising fact that with a fleet surpassing the navy of the whole world, and by which we are enabled to set so large a portion of it at defiance, we cannot guard our coasts from insult."

As a further indication of the state of things existing, I find "Lloyd's" on December 6th, 1810, publishing a notice recommending all masters of vessels passing up and down Channel "on the appearance of an enemy's cruiser in the day or night to make signals, either by firing guns, burning false fires, or setting off rockets, by which it is hoped, from the number of His Majesty's ships cruising in the Channel for the protection of the trade, many vessels will be retaken if not preserved from capture."

About the same time a notice was posted at Lloyd's in the following terms:—

"The Committee feel it their duty to make known to the subscribers to this House that on a communication with the Admiralty this morning they have been informed that the increase of the number of French privateers, fitted out and fitting from the various ports in the Channel and the North Sea, is beyond precedent. They were at the same time assured that every possible attention has been and will be paid to the protection of the trade."

No sort of *guerre de course* which can possibly be imagined in the future would be worse than that which history thus discloses. M. Aube's astounding fallacies are only another instance of the absurdity of breaking with history that is passed, in attempting to predict history to come. If we are so unfortunate as to have war with our neighbour, and are able, by the admitted superiority of our "grand fleets"—to use the fine old term—to command the sea, it is not to be doubted that she will follow M. Aube's advice. Neither is it to be doubted that we shall suffer much more heavily now, when our individual ships are so much larger and so much more valuable, and when we are so much more dependent on commerce, than we did in 1810. But it is mere nonsense to assume that because the propulsion of ships is different the whole thing will be different; it will not: we may expect it essentially to be the same.

M. Aube is not so clear on other matters as he is in commending the

guerre de course as the true end of French naval policy. He seems to admit that the empire of the sea depends upon main fleets, which for the present are ironclads; yet he condemns ironclads. It is not because of their armour, which is a common objection to them, but he disbelieves in the idea of uniting in one ship the three weapons of the gun, the ram, and the torpedo. He does not show, however, how an ironclad fleet is to be beaten, except by a superior ironclad fleet, and this would seem to imply that his objections are more academical than real. It may also be argued against him that, so far, ironclad ships have been built with what might have been an exclusive eye to gun power. Our own "Polyphemus" is almost the only ironclad ship that any nation has built in which two weapons—the ram and the torpedo—have been co-ordinated; and that experience is not likely to be extended. When the ram and the torpedo are introduced into the ordinary ironclad gun-ships, they come in as adjuncts, and modify in no respect the intentions of the original design. The idea of having special rams, special torpedo vessels, and special gun-vessels has been carried out into practice in all directions, but no one has supposed that it logically removes either the ram or the torpedo from the ordinary ironclad fleet-ship. It is difficult to say whether or no M. Aube is an exception to this rule, or whether he assumes the ultimate disappearance of the ironclad altogether. But the two things are entirely different. The one cannot be maintained as sound argument; the other maintains simply that the attack is the best defence. One authority may maintain that the shield is an encumbrance, and that he prefers to use the sword without it; another may think the advantage of the shield is greater than its encumbrance.

But whatever M. Aube's real views on the often debated question are, they are subsidiary to the great scheme of naval policy which he has unfolded to France, and to all inferior sea Powers. It was of necessity that I should set this out clearly, because it is M. Charmes' groundwork, and must always be understood to underlie every page of the book under review.

But I have one word to say before proceeding, and that is that while I endeavour to take a clear cool view of the policy threatened against us, and desire in nothing to exaggerate its dangers, yet I must admit it to be a real policy, which, if earnestly carried out, will do us more harm than probably any other could. Yet is it a policy which we can meet with success, if only we will take the trouble before it is put in force.

In his first chapter, M. Charmes gives himself up wholly, not only to the torpedo as the master weapon at sea, but to the torpedo-boat, which must by no means be allowed to grow into the torpedo vessel. He admits that French Officers who have practical experience of the torpedo-boat are against him, and it is evident from the course which construction has taken in England in reference to the same weapon, that English experience has ranged itself beside the French. But then he classes both nations together, and says that, in contrast to Germany, Austria, and Russia, England and France "do everything they can to hinder the progress" of the torpedo.

It is generally understood in England that the great objection to the smaller classes of torpedo-boats is their certain and ascertained failure of speed once they leave smooth water. M. Charmes quotes in contradiction the case of two torpedo-boats, 100 feet long, which passed at sea a squadron of ironclads going eight knots. But unless it were shown that these were the most modern types of ironclads and doing their best, the argument in favour of the torpedo-boat would fail. This, however, M. Charmes does not pretend to see. He states that the wind and sea were so powerfully adverse on this occasion, that the "Vengeur" and the "Tonnerre" were unable to proceed, but then he should have further stated that the "Vengeur" was built in 1878, and had only a maximum speed of 10·8 knots, and that the "Tonnerre," though

a 14-knot ship, was not of a character to face a sea. The *prima facie* case against which M. Charnes labours unsuccessfully is that to master the sea the vessel must not be disproportionate in size to the waves she has to encounter. The problem of maintaining speed becomes more difficult as displacement is diminished, and although wonderful results may have been produced on a very small displacement, still better results will be more easily produced on a larger displacement.

"In attacking squadrons," says our author, "torpedo-boats ought to possess the greater speed." It is, however, a thing impossible, to give the greater speed to the smaller vessel, and the mere admission that such is the necessity of the torpedo-boat would be, to a closer reasoner than M. Charnes, a surrender of the argument. What is done for the small vessel can certainly be done for the large, and if a superior speed would give to the 100-feet torpedo-boat the power over a larger ship, it can be but temporary, as the next ship launched would have the superior speed secured to her; and every improvement which may be made in the speed of the torpedo-boat can be more easily made in the larger ship.

But this unattainable permanent superior speed in the torpedo-boat is necessary in order that she may force herself within torpedo range—which M. Charnes admits to be no more than 400 yards—of the bigger ship.

"The sea-going properties of torpedo-boats have therefore," says the author, "been completely proved. Their worth, from a military point of view, still remains to be seen. But many naval men assert that, small though they be, torpedo-boats would never escape the vigilance of ironclads, as they could be distinguished at a great distance, and would certainly be sunk before reaching them.

"Ironclads are armed with special guns, Hotchkiss, Nordenfellt, &c. They are very light, and are placed in the tops and all along the ships' sides, where they can open fire on all assailants. But this means of protection is much less certain than is imagined, and it could only be used if the torpedo-boats were seen when far enough off to be kept for some minutes under fire by the ironclads.

"Thanks to their speed, the torpedo-boats can advance with lightning rapidity, and if only perceived at a distance of a few hundred metres, nothing could stand any chance against them. The danger is less imminent in daylight, when, unless there is a fog, or the smoke of battle envelops the ship, the eye can sweep the whole circle of the horizon without intermission.

"The ironclad is provided with two electric lamps, and they cast their rays far over the sea. But these rays only light up one spot at a time; all the rest is plunged in shadow, made all the deeper by the contrast. If the ironclad is attacked by several torpedo-boats, it may be able to sink one or two that it has sighted by means of this electric light; but whilst conducting operations it would probably be blown up itself by the others. Moreover, everyone knows how a constant and active watch exhausts a naval personnel, especially when its cause of anxiety is the gravest peril. An ironclad pursued by torpedo-boats is condemned to an incessant watch, enough to demoralize the most veteran crew. The machines themselves suffer from this perpetual strain; the electric lamps have always to be kept alight, always to be in motion, and become worn out in this forced service. At first both men and instruments are perfectly ready and in good condition, and are therefore proof against any surprises. But in the long run, fatigue, uncertainty, and sustained effort produce unavoidable consequences. A few seconds of lassitude and forgetfulness on the part of the sailors or Officers of the watch suffice. Some mechanism may go out of order, a luminous ray may go out or deviate, and horrible disasters result.

"These are not purely theoretical arguments and inductions devoid of

truth. At night the result is certain. Big vessels of moderate speed have been attacked by torpedo-boats in our own experiments, as well as in those of certain foreign squadrons. Everywhere the result has been the same. Everywhere the dwarf has killed the giant. Everywhere the big ship has been reached by the destroyer, and been unable to resist it. The movable defence force at Toulon was the first to attempt these experiments in warfare. Watchful as the ships might be, and forewarned as they were of the intended attack by the torpedo-boats, and supplied with powerful electric lights, the torpedo-boats had invariably the advantage over them. One or more of the assailants was always able to get near enough to the vessels they were attacking, and to discharge the torpedoes with unerring aim before there was time to signal their presence."

This is M. Charmes case of torpedo-boats *versus* ironclads, and it will be observed that it is not torpedo *versus* gun, but torpedo in a very small boat *versus* any other sort of arrangement that can be made. This statement of case has not special application to anything but large-sized ships of moderate speed, though for present purposes the ironclad is selected as the type to be condemned. And this is because of contrast in cost.

"It is generally admitted," says the author, "that at least three torpedo-boats (39 men and 600,000 francs) are required to combat one ironclad with any chance of success (700 men and 20,000,000 francs)."

M. Charmes cannot be said to offer any detailed proofs of the strong assertions given in his opening statement. As a matter of fact he only produces a single experiment, and that not in detail. Two torpedo-boats, under what he represents as exceptionally disadvantageous circumstances, attacked a squadron of six ironclads, and got within 1,200 yards at night before they were seen.

But then M. Charmes believes that a deep-laid conspiracy against his favourite exists, for "care was taken not to renew" the experiments "in the squadron, for fear that the result might again be in favour of the engine and boat, against which there is such an inveterate prejudice." Then he adds a little note, "A new experiment was however tried, last spring (1885). Three torpedo-boats attacked the squadron with complete success. But silence was maintained as to this fresh proof, even more decisive than the first."

It will probably be seen that M. Charmes' aim is to drive the ironclad off the sea, and to stop the building of any more of them in France. But we must recollect that it is the ironclad of M. Aube's enmity—the unity of gun, ram, and torpedo on one bottom—which is M. Charmes' object of dislike, and that M. Aube appears to admit that after all the empire of the sea rests within her frames.

"In dealing a mortal blow at the ironclad, the advent of autonomous torpedo-boats, armed with locomotive torpedoes, at once puts an end to the race which has for some years gone on between the ironclad and its guns. As soon as the armour has disappeared, shattered by the torpedo, the big gun will no longer have any function to fulfil. It might indeed be employed against protected batteries at the ports or on the coasts; but this would be to condemn itself to certain failure. . . . If ironclads are driven out of the field by torpedoes, we shall no longer require armour-piercing guns for naval engagements. What we want is guns powerful enough to stop a mail steamer or an unarmoured cruiser, or at most to demolish the present superstructure of ironclads, and to destroy the service of the guns."

"Far-seeing naval men have long predicted that the most terrible danger threatening the ironclads in any future naval warfare will be when they are assaulted on several sides at once by a series of agile gunboats, difficult to hit."

In support of these views, M. Charmes quotes a German periodical of 1883:—

"It would be easy for a small vessel armed with three or four small guns, and with its vital parts well protected, to attack a vessel like the 'Inflexible' or the 'Italia' from astern, and taking advantage of the rapid firing, further to reckon on a shot hitting the muzzle of its only gun, or else smashing or destroying the unarmoured parts. We do not want monster guns on our beautiful and powerful ships. We ought to adopt guns easier worked and easier served. Let us leave monster guns to giants; they offer too large a target to the enemy's fire and are too easily hit."

"Convinced by these facts," proceeds our author, "we must first find out the gun we can best utilize for our Navy in the system of war we think is to be that of the future. We shall see next on what vessels we must place them."

Without much argumentation, M. Charmes pitches on the 14-cm. gun. "Its projectile, which weighs 30 kilos. (66·1 lbs.), will do more damage in a quarter of an hour than the balls from the great guns; for the effect of one monster ball will be supplemented by the number of bullets of a smaller size, and rapidity of fire will compensate for everything else."

The view taken by the German writer might easily be mistaken for that earlier one which is responsible for so many of the products of Lord Armstrong's yard at Newcastle. This view assumes that the ironclad was unconquerable by artillery unless it was armour-piercing; but it was seen to be at least a debatable point whether a sufficient number of armour-piercing guns to master any ironclad could not be sent to sea in numerous unarmoured structures at a much less cost than that of the ironclad herself. I myself fully debated this question in the Prize Essay for 1877, and explained how *defence by resistance* might be met by *defence by avoidance*, i.e., the smallness of the target offered by the vessel, which was simply a floating gun-carriage.

But the German writer is ready to abandon the armour-piercing gun altogether in the attack on the ironclad, and the mere propounding of such an idea testifies to a disbelief, such as Sir Edward Reed has often expressed, in the really armoured character of the more recent so-called ironclad. We can hardly escape from defining an ironclad to be a ship unconquerable by light guns, a type very fitly represented by such a ship as the "Minotaur," which is even now practically impervious to anything below a 4-inch gun. When we defend a ship so that, though a small part of her is impervious to anything but very large guns, a very large part of her is penetrable to guns of the lightest power—almost to rifle-shot—we raise debate as to whether the part of the ship which we have heavily armoured is the only part which is "vital." And then we have to define what we mean by "vital." There are two kinds of vitality in a war-ship—material and moral. In all former wars most ships were captured by attack on their moral vitality, and we have not full evidence as yet to show that there is anything else before us, though no doubt the great mass of opinion is on that side. The German writer hopes to win in the old way, and to capture a ship which is no more materially injured than the "Huascar" was when she succumbed to superior force.

M. Charmes, though he uses the German authority to strike a blow at his abominated ironclads, does not apparently go the whole way with him. The function of his 14-cm. gunboat is not the attack on ironclads, which are to be put out of harm's way by the torpedo-boat, but for the attack on merchant ships, coast towns, and undefended ports, the real aims of modern naval war. According to M. Aube and M. Charmes, a gunboat of 150 tons, carrying one 14-cm. gun, might not unfitly represent the vessel of the future.

The summary is this. At the date of writing this first chapter (1884) Admiral Gougeaud had set down a sum of 130,000,000 francs as necessary to complete fourteen ironclads then on the stocks. "Take," says M. Charmes,

"14,000,000 francs off this sum for cruisers, repairs, outlays, and 116,000,000 francs would remain, with which we might construct the best fleet of light vessels in the world. It would comprise 45 gunboats with the 14-cm. pattern, costing 1,500,000 francs each, and 200 torpedo-boats at 250,000 francs each. With such a fleet we should be irresistible on the Mediterranean and invincible on the ocean! But the authorities prefer to swallow up millions in the construction of ironclads which never were any good and never will be!"

It will be seen that while between M. Aube and M. Charmes there is a close alliance of idea, it is not exactly clear what that idea is. For M. Charmes the outcome is the abandonment of ironclad building and the laying down of these mosquito fleets instead. M. Charmes anticipates in the event of war with England to be able to drive her ironclads off the seas with his torpedo-boats, and to destroy her commerce and her coast towns with his gunboats.

Though M. Aube says that the ironclad, which is to him, we must be continually reminded, any kind of ship which is at the same time a gun-ship, a ram, and a torpedo-ship, "is not now, and never has been, the most effective instrument of maritime war," yet he does admit that she will give to the superior sea Power the empire of the sea—so far as all concerted or organized operations are concerned. But still she cannot last as a type, not be it observed because some other prominent type may be substituted, but because in uniting the use of three weapons on one bottom she is philosophically wrong. Her doom is sealed not apparently by M. Charmes' torpedo-boats, but by the development of the three weapons in three separate bottoms. The case is put clearly, he thinks, when we contemplate a single ironclad (*cuirassé d'escadre*) struggling at once against a ram, a gunboat with a single heavy gun—a simple floating gun-carriage—and four torpedo-boats, all having and being able to develop through all the changes of the combat the superior speed. Could an ironclad fleet-ship, he asks, so attacked, be able to resist the simultaneous assault of these adversaries? M. Aube says this question has been discussed at the English Admiralty, but I have never heard of such a discussion, and I hardly think it could be entered on by an English audience. We should dismiss the question as academical. We should want to see the vessels with the superior speed in the first instance; then we should want to know whether the six vessels could be produced at less cost than the ironclad; and then whether we were to be allowed to arm the ironclad as we chose. When these points were all settled, we should ask whether we might not have all gunboats, or all rams, or all torpedo-boats, seeing that by the hypothesis each is equally competent to do the business of the ironclad.

But M. Aube leaves all these points aside, and practically invites the discontinuance of ironclad building, not only by France but by all maritime nations.

France, however, in any case, he holds ought to discontinue building ironclads to rival England's great sea fleets, because the pursuit is hopeless and because the weaker ironclad Power will always have the advantage of abandoning her sea commerce and devoting herself to destroying the other.

The policy recommended, whether by M. Aube or M. Charmes, is involved, complicated, and unthought out, except that part of it relating to the practical position of France in reference to England.

Neither author seems to give a thought to the real reason while the nations still go on building protected (using the term to include ironclads proper) fleet-ships. Neither seems to see that it is impossible that the floating gun-carriage, the ram proper, or the torpedo-boat, can remain when the ironclad has gone. They are each and all of them answers to the ironclad and nothing

more. Who would build a floating gun-carriage to attack a like instrument of war? Who would ram a ram, or torpedo a torpedo-boat, if he could employ other methods of attack? Just as armour has been the answer to the heavy gun, so has the torpedo-boat, or the ram proper, been the answer to armour. If the effect removes the cause, the effect itself must follow. No one would have built a ram to attack a torpedo-boat, and no one would build a torpedo-boat to attack a light-draught ram. And however we look at it we must be quite certain that the ruling instrument of naval battle must be a compromise. The line-of-battle ship of old surrendered her speed for the sake of her gun power and her great crew. The frigate surrendered both these for the sake of her speed. The fleet ship all over the world is now seeking the compromise, and if no new weapons are invented it will ultimately find it. We can see where it has been searching and turning back in one or two directions. It began with a great many guns and thin plating. It went on increasing the power of the gun and the thickness of the plating, until it found it had too few guns and too little area plated. It is now developing secondary armaments and other methods of getting some of the protection which armour gave it, while it is beginning to offer direct resistance to the torpedo. It is developing speed as a direct answer to torpedo-boat attack, but it is not surrendering its ram or its power of firing torpedoes, because neither of these weapons have been found to hamper it in the least; but it has painfully and with much heartburning surrendered its sail power because it found that it could not meet the new weapons and retain it.

These are thoughts which seem to me to lie about everywhere the moment one enters on speculations as to what naval policy should be, and though we may see that the torpedo-boat and the ram, or the floating gun-carriage, may be like fortifications and submarine mines, very effective *local* answers to the fleet-ship—they cannot drive her off the sea or become themselves her substitute.

We should perhaps naturally suppose that when M. Charmes entitled his second chapter "Naval Warfare and the Organization of Naval Forces," he intended to develop the thoughts I have expressed above; or if not, at least to say distinctly that his view of naval policy stopped short at arranging the best method of destroying the ironclad fleets of England. He does neither; he has developed M. Aube's articles in the "Revue," but has not advanced on them or given them precision in any way, unless the following can be said to do so.

"The existing squadrons must still be fought, as they will probably continue a few years longer in existence. We are about to prove that our transports, gunboats, and torpedo-boats will suffice for this purpose.

"In order to give more precision to our ideas, we will classify our vessels in groups, which we shall name *fighting groups*, each to be composed of two gunboats, four attacking torpedo-boats, and four defensive torpedo-boats. It seems to us that a group thus constituted would combine sufficient strength to overcome any ironclad or big vessel."

It is necessary to remember what the ships comprising this group really are. M. Aube's rams, too, it must be observed, are discarded, the reason given being that "to work them against large ironclads the rams would need to be of equal size." The 14-cm. gunboat is to carry a single gun apparently, but is to have a speed of 20 to 21 knots. A writer in the "Yacht" took M. Charmes to task on this claim, and showed that, based on existing types, a gun-vessel with 21-knot speed would be a good deal larger than he supposed. M. Charmes (in the appendix) thereupon shows himself ready to abandon, for the present, speed for small tonnage, and accepts a 350-ton vessel with two 14-cm. guns and 18-knot speed.

The offensive torpedo-boats are 41-metre 71-ton boats, and presumably with

20 or 21-knot speed. Each is to have two tubes and four torpedoes. But she is on no account to have any machine-guns lest she might be tempted away from her proper duty. The defensive boat is to have only the spar torpedo and three or four large Hotchkiss guns, and she probably would not be larger than 50 tons with a length of 36 metres.

None of these vessels are to be capable of keeping the sea for any time. They are to depend on an accompanying transport for their supplies of stores and provisions of all sorts. They might therefore be found at sea short of everything because the weather has not been such as to allow of transfer from the transport.

But such as they are they may proceed.

"Let us suppose," says M. Charmes, "a hostile squadron, made up of ironclads, torpedo-boats, and look-out ships. The moment it is seen, our torpedo-boats and gunboats, profiting by their speed, will surround it on every side. The gunboats and defensive torpedo-boats will lead the way, attacking the look-out ships and hostile torpedo-boats, and clearing the way for the attacking torpedo-boats, which will be close behind them; they will do the utmost possible harm, and make as much smoke as possible, so as to conceal their companions in the fight. If they succeed in making the gap through the light vessels of the advanced guard, which is more than likely, the attacking torpedoes will not proceed at their maximum speed till the ironclads, firing their big guns, are surrounded by the cloud of smoke which invariably masks the view after the first round; then nothing will stop them; if they can only muster in force success is certain."

Nothing could probably be more loose and indefinite than all this. We start with the idea of attacking an ironclad squadron, but we find that we are to meet, not only this, but also an attendant squadron of light vessels. But if we do not create a different hypothesis, the ironclads may claim to have nothing but vessels every one of which would be more than a match for each French vessel, and to have also a superior number. There is therefore absolutely nothing to go upon in M. Charmes' hypothesis.

But supposing we take his data as it stands, and assume that his flotilla meets a single ironclad at sea. We then have to accept a tremendous assumption, namely, that while the flotilla has been prepared specially to meet the fleet-ship, the fleet-ship has not been specially prepared to meet the flotilla. But accepting it for the moment on the understanding that the whole thing is a temporary matter—an experiment to show that the ironclad must be modified—we then have a recent type of ironclad, say, the "Edinburgh," caught at sea by the flotilla. M. Charmes allows her to sight the flotilla 6 miles off, but in this case we suppose distance is not material, as the "Edinburgh" means to fight and not to escape.

If the flotilla is to be able to steam 18 knots—the maximum speed of the gun-vessels—we must allow the "Edinburgh" to steam $15\frac{1}{2}$ knots, her maximum speed. As the only thing she has to fear are the torpedo-boats, her endeavour must be to keep out of torpedo range. She therefore at once turns her stern to the enemy, and proceeds at her full speed, opening fire at possibly 4,000 yards with her four heavy guns with shell. Practically, the main question is whether these torpedo-boats can sustain this fire, as well as considerable quick and machine-gun fire for about an hour. It is not, I presume, to be supposed that the spar torpedo-boats would be of any service as such. Planting a spar torpedo against a ship going 15 knots could probably be only done under the quarter, but this would leave the boat to certain destruction, as she would be almost permanently under overwhelming fire for some time before she could actually touch the ship. If the Whitehead torpedo-boats divided themselves and passed out on either quarter, they would only pass into a heavier fire for a longer time. Then the question

would after all be whether, supposing the boats did live through the fire, and did discharge torpedoes, they would make effective hits. And again, it has to be shown that these hits would either sink or so disable the "Edinburgh" as to cause her surrender.

It is possible that opinions might be evenly divided in favour of either combatant, though probably no one would follow M. Charmes in believing the success of the torpedo-boats to be "certain." It will not be disputed at any rate that to win in such a battle the Commanders and crews of the flotilla must be very exceptional persons, while the Captain and crew of the "Edinburgh" may be very ordinary persons, there being little or nothing to disturb their nerves except the abstract fear of the torpedo.

M. Charmes is perhaps hardly fair in claiming that the smoke must always be against the ironclad, and in favour of the torpedo-boat. At considerable distances a skilful tactician may be able to fight so as to have the best of the smoke. But a dense bank of smoke between a torpedo-boat and an ironclad may, when the distance between them is a very few hundred yards, hinder the aim of the torpedo just as much as the aim of the gun. In the case supposed, if the "Edinburgh" were before the wind, which did not differ much in speed from that of the ship, she might be very much hampered, and the torpedo-boats very much aided by the bank of smoke collected round her. But if she were steaming head to wind, or if it were calm, she would steam away from her smoke after every discharge, which would roll down like a fog on the flotilla, and possibly disorganize it like any other fog. Were the wind across the range it might be difficult to say whether either side could gain or lose by the smoke.

When we think of a fleet of, say, 12 ironclads, and consider that according to M. Charmes' calculations, 24 gunboats, 48 offensive and 48 defensive torpedo-boats would be required, we are struck by the thought of the practical difficulties of the undertaking. First the maintenance of order and concentrated attack, carried on as it must be by signal, is difficult enough in smoke with only 12 ships. It would seem impossible with 120, when they must be in three divisions with divergent aims.

Then when we push our thoughts so far as to consider that the 12 ironclads might do as the single one did, we see them in line abreast steaming away full speed with their sterns to the flotilla. The boats of this latter must approach in some formation. That of the ironclads only occupy 46 cables in front; if the flotilla takes up more, the wing ships must be so much longer in their approach. If the flotilla spreads no more, or less, it must be crowded and suffering proportionately from the fire. It appears, however, almost obvious that though M. Charmes has brought the gunboats and defensive torpedo-boats in to share a supposed fight with light vessels, they have nothing to do with the argument, being capable of being struck out of both sides of the account, and that the real question is simply whether 48 torpedo-boats are really superior in the open sea to 12 first-class ironclads of latest type. Put so, it is seen, I think, that a line abreast of ironclads which can keep a line of torpedo-boats under fire for an hour before they can get within torpedo range, is an exceedingly awkward body for the latter to handle. It is one thing, two torpedo-boats running up on each beam of an escaping ironclad, and quite another, two torpedo-boats each running up between two ironclads, which is the normal condition for the attack on the line abreast. Probably it would be impossible to win thus; and it would be necessary to attack the wings. But this is a long operation, and a change easily noticed. It could be met by simple changes in the line abreast, which would still have the boats at a disadvantage.

On the whole I presume the reader, without being able to give a verdict in favour of the ironclads, will say "not proven" to the case of the torpedo-

boats—remembering the extreme unlikelihood of their having generally that superior speed which is all-important. The verdict is not, however, such as to justify founding a policy on, and we are not surprised to find that the French Budget Commission of 1886 did not go so far as M. Charmes, and that M. Aube as Minister of Marine was more cautious than as reviewer. We are told that the President of the Budget Commission of 1886 epitomized the views of M. Aube, the present Minister of Marine, as follows :—"It is not necessary to indicate the time when the construction of large ironclads will come, nor to give up those ships, as all other maritime Powers continue to build them. The ironclad does not, in the way of progress, lag behind the torpedo-boat, and if we succeed in finding a protection for the ironclad, the torpedo-boat will be annihilated."¹

But all this discussion has a most important bearing for us. Both M. Charmes and M. Aube (the reviewer) may be entirely wrong in their speculations, and entirely right in their practical advice, which has really little to do with their speculations. As against England they both say, and rightly say, it is little use taking up *la grande guerre* at sea. They see how surprisingly open we now are to injury by well-directed efforts against our commerce, and our open towns and harbours. It is exceedingly likely that their advice to their countrymen may be of the soundest character if it be once admitted that they cannot attempt with an ironclad fleet to meet one of ours in fair fight on the open sea. But in my opinion they will find it necessary to carry out that policy, not by a few specially built vessels, but by numerous vessels which are privateers in all but the name and the method of distributing the property captured, of which there may not be much.

M. Charmes goes further than M. Aube in the belief of the hopelessness of blockade. He seemingly believes that in removing the ironclad from the sea he takes away blockade also, ignoring, that is, the whole experience of the Federals, and reading their history as though they had given up blockade altogether because it was sometimes broken. Whereas we know that what they really did was to press the blockade continually in and in, until, resting ever on the sea as their base, they possessed themselves of the Confederate ports one after another. Such a book as M. Charmes', and such papers as those of M. Aube, might very well be held to show us that while we are open to great dangers, they may, by proper steps being taken, be much mitigated, if not removed.

M. Charmes is on sounder ground of general naval policy when he comes to coast defence. It must strike the reader as a piece of true English in-consequence, when he finds a Frenchman stating that in France the defence of the naval ports is in the hands of the Admiral, and not of the General, and claiming the whole of the French coast should be put under the command of the Admiral, *as it already is* in the great military nations of Germany, of Austria, and of Russia. None but the supremely illogical English would habitually express the greatest fears of coast attacks, and yet as a naval nation refuse to put the Navy in command where all the great military nations have already put her. But it is part of the absence of any real military policy that it should be so.

No doubt M. Charmes cannot be reasonably met in opposition to his claim that the torpedo-boat has become of the essence of coast defence. This and the light gun-vessel, locally placed, are not only the first answers to organized attacks, but they are the best, if not the only, practical answers to that class of depredation with which the weak sea Power threatens the strong in M. Charmes' volume. M. Aube shows us the "Augusta" making for the Gironde, but only because she was aware that she was unlikely to meet a watch-dog amongst the sheep, on which, like a wolf, she designed to prey.

¹ "The Naval Annual," 1886.

The mere knowledge that a watch-dog was habitually there would have been sufficient to have protected the Bordeaux shipping.

For the organized attacks to which the coasts of the inferior naval Power are now open, further defence is found in submarine mines, and lastly in fortifications, according to M. Charmes. M. Aube points out that fortifications have lost some value in modern times in all cases where they may be passed by the ironclad; and he considers that naval ports are no longer as safe as they used to be from the attacks of the superior sea Power. It is remarkable how clearly he always seems to have in his mind the distinction between the superior and inferior sea Power, even though he suggests that in some way our ships suffer the attacks of a victorious enemy.

I believe that his views, and those of M. Charmes, are in the main sound on the question of coast defence. It appears also that the torpedo-boat may fall back to her true position, as always resting on a territorial base. Then she is a true defence. She does not compete on the high seas with the fleet-ship, but she is always a warning and a trouble to the fleet-ship should she herself step out of her element and become the instrument of territorial attack. But the instinct of the superior sea Power ought to be now for what it was when St. Vincent was First Lord of the Admiralty. These weapons, which require *opportunity* for their attempts, are properly in the hands of those who are tied to opportunity; they are not the true instruments of those who make their own opportunities.

M. Charmes in his fourth and fifth chapters deals with the personnel of the French Navy, they are perhaps as interesting as the rest of his book, although they do not concern the English reader so closely as do the chapters I have already examined at large. He attacks the Maritime Inscription roundly and fully, and apparently with a good deal of truth. He declares it produces "topmen" only, and many other men besides topmen are now necessary. It is well known that even the Tonquin business reduced the French Navy to great straits for Officers, but we in the English Navy must be careful how we boast ourselves on this head. We have accepted an enormous reduction in junior Officers in proportion to men, and we have substituted men from the ranks in many directions. We know absolutely nothing of what the effect will be in war. All we know is that English seamen have always been accustomed to follow the lead of numerous Officers drawn from ranks socially far above them. We should enter on war having broken in this matter with history, and without experiment to guide us. One comfort from M. Charmes' book may be drawn perhaps, from his showing that our neighbours are in much about the same condition.

The book is one which ought to be handy on our book-shelves. It discloses facts, lines of thought, and possible lines of action on the part of the French which every naval Officer should be acquainted with. It has a bearing on our naval policy, whether we agree or disagree, and it forces us to think out naval propositions of the highest value to us. The translation is admirably done; it is not only readable, but accurate in technicalities, and I at least have to thank its authors—for I must include Admiral Aube—for the very interesting moments devoted to its study.

P. H. COLOMB, *Rear-Admiral.*

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POLA.¹

THE little monograph on Pola now before us is printed in excellent type and provided with well-executed plans and illustrations. Its author is anonymous, but both the contents of the work and certain omissions appear to show that he is a citizen of Pola, and neither soldier nor sailor. His style is clear and straightforward. He does his best to interest, not only his fellow citizens, but all Austro-Hungarians and even foreigners, in his object, which consists in making known the strategical and commercial value of Pola, in defending it from certain current aspersions upon its salubrity, and in recommending the improvements which he considers necessary to render the place suitable in every respect for remaining permanently, what it has already become, the headquarters of the Austro-Hungarian Navy, one which though not of the first class is still too strong to be left out of count, and one whose strength is likely to receive much greater development if Austria-Hungary should acquire a port, as it probably will, in the *Ægean Sea*.² The author assures us that "as the root of a tree is to its stem, so is Pola to our fleet, so intimately are the two connected with and dependent upon one another. Thus whatever seems to improve and develop the fortress, the harbour, and the town of Pola, whatever contributes to its social welfare, strengthens at the same time our fleet for its duties both in peace and war." In the chapter which follows we have a sketch of the history of Pola from its foundation by the Romans in the second century B.C. through its period of glory under the Empire, when the noble amphitheatre arose which is still an object of interest to the antiquarian and the tourist, through that of its decline in the Middle Ages to its downfall in modern times followed by its second birth under Austrian rule, and its increased importance which is constantly increasing. This importance is primarily due to its geographical position at the extremity of the Istrian peninsula, which protrudes into the head of the Adriatic to a distance of 60 English miles, immediately flanking the approaches to the two principal commercial harbours of the Empire, on one side Trieste, on the other Fiume, whilst at the same time threatening the possibly hostile port of Venice, whose commercial and military importance is rapidly increasing.

The position of Pola is it must be admitted not central with regard to the coast line of the Empire, which extends some 300 English miles to the south of it, but this coast line is so completely veiled for at least two-thirds of that distance by a dense mass of islands, that no suitable place for a maritime station offers itself till you reach the beautiful natural harbour of Sebenico, which is, however, as eccentric to the northern part of the Adriatic as Pola is to the southern part, without having the advantages possessed by the latter of being close to the great commercial depôts of the Empire, and, moreover, in easy and direct communication with all parts of the interior by means of rail and telegraph. The local advantages of Pola are great from a naval and military point of view. "Its roomy, deep harbour is divided by the islands

¹ "Pola: Its Past, Present, and Future—a Study." Second edition, with four plates giving views and plans. Vienna: Printed and sold by Carl Gerold's Son, 1887. Price 4 marks.

² In 1886 the Imperial fleet consisted of 10 ironclads, 2 unarmoured frigate cruizers, 5 corvette cruizers, 6 torpedo-vessels, 16 vessels for coast defence, 2 river monitors, 34 torpedo-boats and smaller vessels. This fleet is manned by over 9,000 men in peace-time, increased to over 13,000 in time of war. (From "Statesman's Year-book.")

of Caterina, Andrea, and Pietro into an inner and outer port, the latter being again subdivided by the two first-named islands and by that of Olivi into a northern and southern bay, the former of which, called the commercial port, is large enough to accommodate almost all the merchant steamers of the Empire.¹ The war ships in reserve and the training ships are moored in the southern bay, on whose shores and on the high ground above are the naval establishments, the arsenal, barracks, observatory, &c. The inner and outer harbours, comprising together an area of $2\frac{1}{2}$ square miles (geographical), afford a good anchorage, part of which is well sheltered from the wind, for a considerable fleet; the narrowest navigable part of the entrance being about 840 yards wide. The channel of Fasane runs between the above-named islands and the mainland, having two good navigable entrances from the open sea, thus forming an outer roadstead, the anchorage in which is good, so that it would be an excellent gathering-place for a fleet when on the point of sallying forth upon an enemy.² The heights which surround the harbour are well adapted for defensive works, and if properly occupied would render a bombardment impossible.³ At the same time the nature of the coast, indented as it is with bays and studded with islands, presents great facilities for the use of torpedo-boats against a hostile squadron. There is ample room at Pola for establishments of every description required for the construction, armament, and maintenance of a fleet, and of such there is ample provision. The weak points of Pola seem to be its climate, its sanitary arrangements, and its water supply. The author does his best to minimize its disadvantages in respect of these, but his admissions suffice to show that they are considerable.

The situation of Pola exposes it to the south-east wind blowing up the Adriatic on the one side and to the north-eastern blowing down over the snow-clad crest of the Julian Alps on the other, thus subjecting it to frequent and great variations of temperature, the former wind (the Sirocco) bringing with it rain and high temperature, whilst with the other (the Bora) these conditions are completely reversed. One or other of these winds blows on an average 230 days in the year.

The mean temperature of the year is 57.38° Fahr. The lowest temperature recorded being 17.88° Fahr. on January 23rd, 1869, the highest in the shade being 94.64° Fahr. on July 18th, 1881. The average number of days on which rain falls in the year is 108, and the average annual rainfall over a period of 18 years 36.99 inches. The disease, which in former days gave Pola the nickname of the *Cayenne* of Austria-Hungary and with it a bad reputation which still clings to it to a certain extent, is malaria, whose prevalence is due in part doubtless to climatic influences, but still more to a defective water supply and to bad sanitary arrangements, has much diminished of late years since it became incumbent upon the State to act with some vigour in the matter for the sake of its naval establishments. According to the Admiralty statistics the number of cases of malaria in 1877, '78, '79 amongst the 5,000 men on shore and afloat at this station amounted to 223, 234, 480 respectively, whilst in 1883, '84, '85 the record fell to 82, 85, 95. The rate of mortality is not quoted by the author, rather a remarkable omission, and he moreover informs us that although the authorities of Pola have been very industrious in the collection of meteorological and other statistics they have provided "but

¹ In 1886: Seagoing steamers 61, tonnage 69,452; coasting steamers 82, tonnage 14,491. ("Statesman's Year-book.")

² This is the substance of the author's remarks on the subject of fortification, to which he does not again allude. It is very unlikely, however, that the principal naval depot of the Austro-Hungarian Empire should remain unfortified, and the author's silence proceeds possibly either from caution or from unacquaintance with the subject.

few data on which to form an estimate of the amount of sickness and mortality amongst the civil population beyond the number of admissions to, and of deaths in, the town hospital." This is remarkable, as is also the fact that the author, who is so anxious to do away with the bad impression which still, as he says, continues to prevail in some parts as to the salubrity of Pola, omits to furnish us with even the meagre information to which he refers as existent. There is reason to fear that a complete statistical statement would be by no means satisfactory when we become acquainted with the following facts :— Up to 1859 the inhabitants and ships' crews had to fetch all their water from one open spring near the amphitheatre. A reservoir was then constructed and steam pumps established which fill it from this same spring. These works have been much extended between the time of their creation and 1876, so that there is now a fair supply of water throughout the town and dockyard sufficient for ordinary times but not in case of war, when in all probability the demand would be increased by one-half. Moreover, the course of the water which supplies the spring is such that it might be choked and the supply to the town be partially or completely interrupted. The quality of the water is far from good. It is never clear, and after heavy rains of a reddish-brown colour ; it is, moreover, not free from the suspicion of being polluted by organic matter. Various measures have been proposed in order to remedy this state of things, the most promising being to sink artesian wells, the geological formation being of such a nature as to promise a good supply of water at a moderate depth. With regard to sanitary arrangements, there is still much to be done before Pola can ever attain a fair average in this respect. A large proportion of the houses have no latrines, the results of which deficiency require no description. Sewers are entirely wanting except in the military and naval quarters of the town, but even where they do exist their construction is very faulty, and their outlets being in the sea above low-water mark render the atmosphere of the quays decidedly unwholesome. Yet notwithstanding these serious drawbacks the development of Pola has been remarkable since it became the headquarters of the Imperial Navy in 1849. At the end of the last century a traveller described it as a place "whose garrison consists of nine men, who have more to fear from hunger than from the enemy." The military and naval force now permanently stationed there amounts to about 8,000 men. The civil population, which at the beginning of the century numbered only 600, rose by 1848 to 1,100, and by 1885 to over 19,000.

There is probably a great future in store for Pola, but energy is required in developing its resources and in making it fit for the important position which it has to fill.

A glance at Plates II, III, and IV, at the end of the volume, will enable the reader to realize the great improvements already accomplished. The first is a view of Pola at the beginning of the nineteenth century, the second a view of Pola as it is now, whilst the third contains plans of the town and harbour as at present, and also as they were in 1836.

LUMLEY GRAHAM.

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THE NEW FRONTIER OF FRANCE.

By Lieutenant-Colonel C. COOPER KING.

So many years have passed since the great war of 1870-71, that the causes both of the struggle itself and of the total collapse of the French Army are being one by one forgotten. Any examination of the existing state of things in the Rhine valley can only be properly understood if its former condition be known; any prognostication for the future can only be made by comparing the modern value of the armies with their relative worth seventeen years ago. Therefore it seems advisable to examine with the greatest brevity how matters stood in 1870, and how, in a few words, that campaign was fought. Without such introduction it would be difficult to forecast or compare.

Few even of the leading soldiers and politicians of Europe when 1870 dawned, could have foreseen how that year would close. Irritation, consequent on the sudden and marked success of the armies of Prussia in the Bohemian campaign of 1866, was known to exist, and the knowledge was accentuated by the serious diplomatic discussions which took place a year later regarding the neutrality of Luxemburg. "Königgratz had given a rude blow to her fancied supremacy among the natives of Europe; and all the soldier spirit of the Empire was ready to rise in arms against the military *parvenu* who had presumed to contest with her the leadership in the art of war." The old sore as to the rightful ownership of the whole of the left bank of the Rhine had never been healed since the Napoleonic era. The French people looked on the eventual extension of their eastern frontier as their natural destiny. French poets, with ill-advised fervour, fanned the flame of conquest.

Under such conditions little was needed to bring matters to a crisis. The cause was in itself insignificant. The nomination of a Prince of the House of Hohenzollern to the vacant throne of Spain, an appointment that, bearing in mind the strong feudal allegiance which links that family together, would not have been permitted without the sanction of King William of Prussia, roused the utmost indignation in France. To have a possibly powerful Spain, under a German Prince, on her southern borders might prove a serious matter if war broke out on the Rhine. Thinking so, or, if not, utilizing the incident to pick a quarrel with her old antagonist, she demanded not only that the Prince's nomination should be withdrawn, but that his candidature should never be repeated.

When the King of Prussia refused to accept such imperious dictation, the usual diplomatic rupture followed, and France, ill-prepared and unready, entered "with a light heart," as one of her Ministers said, with what she found to be the greatest military Power in Europe.

And yet she might have known even then how slight her chances of success were. In 1859 she had found a difficulty in placing in the field but one half of her nominal armed strength. If Germany united to resist a French invasion, a course that was quite possible, then her armies would far outnumber those of France. There was little doubt but that such union would be effected. Whatever ties of religion existed between the States of Southern Germany and France, they were as nothing to those which bound all German Principalities together as members of a common Fatherland. Past experience of French invasions was not likely to lead Bavarians and

Badeners to join hands with the invader, however much they may have resented the action of Prussia towards the armies of the Bund in 1866. Hanover, though conquered and absorbed, was still German, and to count on active aid from her was then a doubtful measure. Denmark alone was likely to join in a French invasion of Germany, but only when such had reaped a full measure of success.

It was not merely in this want of appreciation of the state of the political atmosphere that France was blind. She might have known, and her leaders did know, the value of her adversary's organization and numbers. Her only points of fancied superiority were in the hope that German unity was unreal, that its northern and southern elements could be used one against the other, and in the possession of mitrailleuse batteries, the power of which was entirely overrated, and their tactical employment wholly misunderstood.

Report after report had been furnished, ever since 1866, from the Military Attaché at Berlin, which contained the fullest information on these points. Baron Stoffel's letters teem with warnings, which now read like prophecies. He had studied the preparations of the Germans both in peace and in war. He had noticed their preparedness as regards accurate knowledge of frontiers adjacent to their own, and he writes in October, 1866, to express his belief that, "a good number of Prussian Staff Officers know our north-east frontier better than any Officer of France."¹ "Méfions nous de l'État Major Prussien," he says later on with emphasis; "Let us beware of the Prussian Staff." There was no excuse for ignorance of the moral and material value of the German Army. He compares it with that of France with a candour that few would venture to show. Speaking of their solid professional enthusiasm, their intense application to the details of their duties, he finishes one despatch with these words: "The work I have seen done was performed with a calm dignity, and with those feelings of strong conviction which so essentially characterize the serious, energetic, and instructed people whose territory extends from the Vistula to the Rhine. What a contrast with the position occupied by the Army in France, which is but an agglomeration of the disinherited of fortune, and in which discipline and the military spirit are being more and more lost."

The marked difference between the organization for war of the two armies at this time must never be lost sight of. In nothing did France learn so much; in nothing has she shown a greater wish to mend. In Germany the units of command were then, as now, permanently localized. Army corps belonged to provinces, brigades to districts, battalions to parishes, and these again were divided into company areas. In every village was a notice specifying its position in the military machine. In France no such system existed.

Hence it was that the German armies could be so rapidly mobilized for war. Generals, Staff, Commanding Officers, knew their places, their duties, and each other, directly the order to "mobilize" was telegraphed from Berlin. Decentralization was the key to the system. Everybody understood what to do, and at once did it. The French Government knew this, for they had been warned of it by Stoffel four years before, when he had forwarded a detailed account of the mobilization of the Prussian Army, even to regiments, and had given the time required as from eleven to fourteen days.

There was another thing to notice with regard to these first preparations for hostilities. The army corps and subordinate units were collected together without risk of disturbance. Formed in their own districts, they only advanced when fully ready for active service. The frontier meanwhile was merely watched by a thin line of outposts.

Thus it was that after the order to mobilize both the active Army and the

¹ *Rapports Militaires.* Baron Stoffel.

Landwehr was issued on the 15th July, the Germans were being transported by rail to the Rhine on the 23rd, and on the 30th were concentrated in three great armies between Coblenz and Gernersheim. The railway systems were planned for such a movement. Nine of them conveyed on the passages of the Rhine, chiefly on Maxau, Mannheim, Mainz, and Coblenz; and from the river four others led to the French frontier about Saarbruck and Weissenburg. These were united laterally, behind the Rhine on its eastern bank by the line from Basle to Cologne. Furthermore, there were eleven good roads which crossed the Northern Vosges, six of which converged on Metz and five on Nancy. Thus both roads and railways were favourable to a rapid German concentration, followed by a rapid German advance.

On the French side confusion reigned supreme. There was no tactical organization for the sudden operations which characterize modern war. The cadres of the larger units were not formed in peace, but were improvised when war was declared. Generals and Staffs were appointed to commands without any previous experience of each other for lengthened periods. Men went to their dépôts in all parts of France for their arms, equipment, and clothing, to be then drafted to the army corps which were being hurriedly built up in Alsace and Lorraine. Such a system of "over centralization" led to inevitable friction, and to the most intolerable confusion. Every element of the discipline which is produced by methodical preparation was notorious by its absence; and the rank and file of the Army were permeated by democratic principles, and enervated by Algerian wars.

The railway lines were blocked with trains conveying the men of the reserve to their dépôts, and back to the Army in the field. Already the supplies for the troops were insufficient and irregular. In fact, the French tried to mobilize upon their frontier, a proceeding under any circumstances risky, and time was essential for it to be efficiently carried out. Skilled Germany, who knew more about French unpreparedness than even Stoffel did of Prussian readiness, was little likely to give them this.

The entire force available for war, therefore, did not amount to much more than 550,000 men, from which must be deducted the garrisons of Algeria and the fortresses; while there were no trained soldiers in second line. Of this force, at the most, 330,000 men could be counted on for active operations. The French frontier at this time extended along the Rhine near Basle to Lauterburg, along the Lauter to Saargemund, north-west to Sierck, a point about midway between Luxembourg and Thionville, and thence near Mézières, Givet, Hirson, Maubeuge, and Lille to the sea. The sphere of operations of an invading French Army was therefore limited by the neutral territories of Luxembourg and Belgium on the left, and Switzerland on the right, unless France was prepared to violate the neutrality of these States, a course both belligerents had agreed not to take. Even in the area at her certain disposal there were physical difficulties of various kinds to be considered. The Southern Vosges between Belfort and the Lauter was a formidable barrier to military operations, but between Lauterburg and the Saar the hill ranges are much more passable and better provided with roads. Doubtless it was advisable for France to carry the war into the enemy's territories; but could she? Already fully aware of the numerical preponderance of her adversary, and of the fact that all the lower and mid-Rhine bridges were in his hands, except Strasburg alone, her perplexities had begun before a shot was fired; and the feeling that retreat was inevitable, even with the dreaded result of temporarily abandoning the Rhine Provinces of the Empire to the invader, was beginning to arise. At first, however, there were these several courses suggested, and they are useful for comparison with what may be open now:—¹

¹ Un Officier de l'Armée du Rhin.

(1.) By Reims, Namur, and Liège, thus turning the whole of the Rhine fortresses.

(2.) By Metz, Thionville, and Luxemburg to Cologne; and then, masking the fortress, to occupy Hanover, assisted by a force despatched in the fleet. In this movement Denmark might have been prevailed on, or coerced, to assist.

Both these plans exposed the direct road to Paris, where only a comparatively small force could have been left for the protection of the central frontier and the capital. None knew better than the French themselves the utter valuelessness of many of the fortresses, while even the most important were incomplete, ill-armed, and insufficiently provided with stores. They could not be counted on much to check an invading tide.

(3.) By Metz and Saarbruck to the Maine; acting thus against the centre of the hostile armies, which would be protected also by the strong fortresses of Coblenz and Mainz.

(4.) By Metz and Mannheim, with the left wing, and by Nancy and Strasburg, and then up the valley of the Kinzig with the right; moving on Frankfort, and either separating the South German States, or breaking up the Confederation. This would turn the left of the stronger Rhine fortresses, but the flank of the movement would be liable to attack from Mainz or from Rastadt.

(5.) By the Upper Rhine from Belfort; but the distance and physical difficulties were considerable, and the line of march and the communications of the Army would have been dangerously exposed.

All these offensive schemes depended on the inactivity of Germany, or on her being so alarmed by the invasion of a force, even if much inferior to her own, as to induce her to assume the defensive.

An offensive plan of campaign was nevertheless proposed by the French Staff, though the only chance of its success lay in defeating, by a rapid movement, the German armies in detail. The Emperor Napoleon proposed to concentrate 150,000 men at Metz, with 100,000 at Strasburg, and, uniting these, to cross the Rhine at Maxau, interpose between the Northern and Southern States of Germany, and attempt to break up the Confederacy. To cover this movement 50,000 men were to be massed at Chalons in reserve. The French railways available for this operation were neither so numerous nor so well placed as those of Germany. On Metz converged two main lines, on Strasburg one, and on Belfort two lines. Uniting these, but running irregularly, quite close to the frontier, was the line Metz—Strasburg—Belfort.

The plans open to the Germans were of a more simple character. To invade France by way of Belfort was out of the question, for it was too far away, and the long lines of communication would traverse the whole of Southern Germany, and would be parallel to the French frontier. There would be a remote possibility of disturbance by French troops from Strasburg. The ground between the latter place and Mulhausen was very unsuitable for military operations, and the only portion of the frontier available was that bordering on the Rhine provinces of Prussia and the Palatinate. To violate Belgium was unnecessary under the circumstances of her adversary's known weakness in every way.

Therefore Germany massed her forces between Treves and Landau, ready to meet the French directly if they advanced from the northern side of the salient frontier, or attack them in flank if they ventured to cross the Rhine on its eastern face. If the opportunity arose they would carry the war into the enemy's territory by the easiest way and the shortest road.

Their first and most natural objective was to defeat the French armies in the field, their ultimate aim the capture of Paris. So centralized was the

political and military organization of the Empire, that the possession of the capital, as in 1814 and 1815, would probably terminate the war.

Early in August, therefore, Germany had concentrated her three armies, the first under Steinmetz at Treves, the second under Frederick Charles about Kaiserslautern, the third under the Crown Prince of Prussia about Landau—the total force amounting to 462,000 infantry, 56,800 cavalry, and 1,584 guns.

The general plan of the German Staff was to pivot the army of invasion on the right, and wheeling forward the left wing or IIIrd Army, to successively turn the natural obstacles of the Saar, the Northern Vosges, and the Moselle, and, interposing between the French armies and the bulk of France, which lay to the southward, to force them against the northern frontier and separate them from Paris. How the battles of Spichern, Weissenburg, and Woerth along the Saar and Vosges, and those of Colombey, Mars la Tour, and Gravelotte on the Moselle resulted in the dispersion or imprisonment of the "Army of the Rhine," are matters of history.

Between the final objective, Paris, and the victorious Germans, even now strong enough to invest Metz and form yet another army for further operations, only interposed the hastily formed levies and demoralized troops of MacMahon. Concentrated at Chalons he hesitated what to do. Dynastic considerations, the known weakness of Paris, the contradictory and ill-advised orders of the War Ministry, all tended to hamper him.

The courses open to him were these. He might have retreated on the capital, which would have abandoned Bazaine, and directly and at once have endangered the Imperial dynasty. He might have accepted battle at Chalons in an inferior position and against superior numbers. He might have retreated on Reims, and, based on north-west France, threatened, as Faidherbe did later, the flank of the German advance on Paris; but this would have left to their fate both Paris and Metz, and have surrendered to the invader the greater part of the Empire. He might have retreated to the southward, and operated, with all southern France at his back, against the Germans at Metz or the army that might attempt to invest Paris. This was probably his best chance, and it will be seen later how France now recognizes it. The most valuable resources of the country would have been with him and covered by him. At the worst he could have retired behind the Loire, and if need be further still, thus attenuating the lengthening line of communications of the invasion. But he took the middle and most dangerous course, and attempted to relieve Bazaine. How that failed need not be told here. It resulted in the catastrophe of Sedan and in the fall of the Empire. The armies of a new Republic rose to protect the birth of a fresh Government for France. Admitting the patriotism of Gambetta and those who followed him, one may still question whether the battle for the Rhine frontier had not been already decided.

But the nation, fierce and indignant, proud of its wonderful military history, thought otherwise. Though its last field army was enclosed within the iron ring that encircled Metz, the "hope that springs eternal in the human breast" was strong within the soul of France; and Blume had reason, as events proved, to write, "La gloire" was the pedestal on which the French Empire had been raised; it fell with its fall, and the country threw itself helplessly into the arms of the first comers who engaged to save 'la gloire.'"

So Paris, with its perimeter of some 50 miles of defended zone, was invested. The army of investment was exposed to danger from the whole of the south of France, and in a lesser degree from the west and north. Faidherbe from Arras, Paladines and Chanzy from Bourges, Garibaldi from Dijon, and finally Bourbaki from Besançon, made successive efforts to threaten the

area occupied by the German communications between Paris and the Rhine. But it was all of no avail. German armies guarded the line of the Somme to Amiens, and held Rouen on the Seine; others occupied the Loire and the districts of the Southern Vosges, and besieged Strasburg, Belfort, and the lesser fortresses.

When the last sortie from Paris on the 19th January, 1871, failed, the usual armistice followed, which prepared the way to peace.

Germany had proved to her, beyond all questioning, that armed men do not make armies suitable for modern war, and that organization is a more serious factor than even superiority of weapons. The Chassepôt was a better rifle than the needle gun, the mitrailleuse had inflicted deadly loss under certain circumstances on the enemy, but this counted little against the strict discipline and perfect mechanism of the armies of Germany.

To suddenly improvise army corps, to build them up piece by piece on the very frontier, was shown to be a fatal delusion. An entire reorganization of the French Army on the German method was the first thing to be thought of. That was of more importance than the fancied superiority of a machine gun.

Germany had converted a frontier that had certain possible elements of strategic weakness into one theoretically secure. She had gained full possession of the Rhine throughout its important political length. Her prisoners of war were armies, for 385,000 men and 11,860 Officers were captives in Germany, and more than 100,000 more were interned in Switzerland and Belgium. She had captured an Emperor, 22 fortresses, 1,830 field and 5,373 garrison guns, as well as 600,000 small arms from France.

But notwithstanding this, was it altogether a peaceful future to which Germany could look forward, or was it inevitable war? Money, defeat, temporary loss of place in the military councils of Europe, France might submit to, if not without patience, still with dignity; but to lose these provinces, to throw still further back her hopes of reaching the Rhine, never! The occupation of all Alsace and Lorraine rendered the *revanche* certain sooner or later.

It is an open secret that Count von Bismarck, the politician, differed from the military hierarchy of the Empire in this matter; he, if report be right, would not have annexed the provinces; but he bowed to the opinion of the soldier spirits, and they had their way. Alsace and Lorraine were by force of arms to be reconverted into Elsass and Lothringen; whether wisely or not is a matter of opinion. Smaller territorial gains would have been certainly safer politically, and very probably sufficiently safe militarily. Had the river line throughout its length together with Strasburg been alone demanded there would have been less dread of disturbance to the peace of Europe, and these claims could not have been called excessive. Strasburg, always as much German as French, and taken possession of originally under circumstances none can justify, would have been but a modest reward for the losses of a war that France herself had provoked. It was not as if the sentiment of the Rhine Provinces was pronouncedly German. Generations had risen and passed away since they had owned German rule. Time sanctifies many wrongs, and Alsace and Lorraine had forgotten their ancient name.

The frontier line between France and Germany has seen many alterations during the past century. The Treaty of Campo-Formio in 1797 assigned the greater part of the Rhine to France as her natural, because geographical, boundary. Even in 1815, by the Treaty of Paris, she was permitted to retain the river from the Lauter to Switzerland.

The Treaty of Frankfurt in 1871 marked out a fresh and even less defined frontier than the one she had held since the old Napoleonic wars. It runs thus:—"Leaving the district of Porrentruy, it follows the Valdeu hills (the

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ridge remaining German), the Southern Vosges to the Donon, the line of separation of the waters of the Sarre and Vezouze (leaving Blâmont to France and Réchicourt to Germany), it cuts the Sanon at the village of Garde (German), follows a spur of the declivity on the left of the Seille, reaches the stream beyond Vic (German), and leaves to France the Canton of Nomény, the only village remaining to her on the banks of that river. Thence it stretches to the Moselle at Pagny (French), follows it for 1,500 metres to Novéant (German), and then, passing between Mars la Tour and Rezonville, touches Conflans and reaches the Chier near Longwy. From this it follows the old frontier."

Thus France lost with the two provinces a population of 1,629,000 inhabitants, less 230,000, who elected to remain French citizens, and therefore were compelled to quit the land of their birth unless they were willing that their children should serve in German armies with the risk of having one day to fight against their former friends and kinsfolk.

The district under consideration naturally comprises the neutral district of Switzerland as well as the basins of the Moselle and intermediate streams, with, to a certain extent, the valley of the Meuse, and the portion of the Netherlands lying between that river and the Lower Rhine; for any extended scheme of operations, and many possible contingencies, might easily convert the whole of the district from Swiss Constance to Belgian Liège into one vast theatre of frontier war.

Speaking generally, the Rhine enters the sphere of military operations on leaving Lake Constance, and forms the boundary between Germany and Switzerland to a point just beyond Basle, where the old French territory met that of Switzerland. At about this point it turns north, receiving on the left bank the Ill at Strasburg, the Moder at Drusenheim, and the Lauter at Lauterburg (where the old French boundary line left it); and passing Mannheim, where the German Neckar joins it, it reaches Mainz at the junction of the Maine, and then turns west and again north. All the tributaries on the left bank hitherto have taken their rise in the Vosges, a range of hills starting from the "Ballon d'Alsace," which is separated from the mountains of the Jura, forming the boundary between France and Switzerland, by the valley of the Doubs and the gap of Belfort. From the same "Ballon" the Faucilles mountains run westward to join the plateau of Langres. This latter hill-land therefore continues to separate the valley of the Doubs and then that of the Saone from the basins of the Moselle and Meuse. A range of irregular mountains forms the western boundary of this basin, beginning at the plateau of Langres with the Meuse hills, and continued by the Argonnes mountains, which terminate at Namur between the Sambre and Meuse, with the bold hill-land of Les Fagnes.

This more or less continuous range forms the watershed between the tributaries of the Seine and Loire on the one hand, and the Rhine and Meuse on the other. Turning back to the Vosges they, from the Ballon d'Alsace, run roughly parallel to the Rhine, past Mont Donon (45 miles south-west of Strasburg) to a village named Salin (30 miles due west of Strasburg), where the range bifurcates; the left branch forming the low irregular watershed between the Vezouze and Seille to the west and the Saar and Nied on the east, and terminating where the Saar and Moselle join; while the right branch continuing by Bitsche and Kaiserslautern again divides, one arm proceeding to Mainz, the other to Coblenz. This irregular mass of hill-land, into which the Vosges splits beyond Bitsche, forms the high-land of Rhenish Bavaria, and is otherwise known as the Hoch Wald and Hardt Mountains.

Between the valley of the Moselle from Thionville and Treves to Coblenz the district to the north is occupied by the difficult and rugged hill-land of the Ardennes and Eifel.

Examining the frontier line which traverses this area with the view of considering its capabilities for military operations, it may be divided into four sections—

- (a.) The Franco-Swiss frontier.
- (b.) The Southern Vosges.
- (c.) The Argonnes district.
- (d.) The Belgian frontier as far as Mons.

Switzerland is in a difficult position. While independent, it covers the Upper Rhine and the South German States from French invasion on the one hand, and on the other protects France from a direct advance on the part of Germany against her southern and central provinces. The only other approach is by way of Belfort, which is closed by the entrenched camp there, and which is otherwise very cramped for the movement of large armies.

As regards the country itself, its eastern frontier between Lake Constance and the Alps is too constricted to have any important military value; and furthermore any movement from the eastward would have successively to traverse a series of difficult streams, such as the Reuss, Aar, &c., which, rising in the main Alpine range, run roughly parallel to the Jura into the Rhine.

In the north, on the other hand, Schaffhausen, the junction of many roads and railways, is a point of the highest strategic importance, as it is the *débouché* of all the roads which turn the Black Forest; and while there are minor points of passage at Lauffenburg and Waldshut, there is one of still greater value at Basle, which is the centre of all military operations in this district. The latter is situated *à cheval* the stream, the two parts being united by a fixed bridge. Any invasion of Germany by France on this flank would therefore probably be attempted between Basle and Schaffhausen. Similarly any attempt on the part of Germany to enforce the neutrality of Switzerland would be made in this same area, with the object of seizing the Aar, &c., as far as Geneva, and blocking, if not offensively using, the passages of the Jura.

The main line of demarcation between France and Switzerland is the calcareous chain of the Jura, which runs from the Rhone to the Rhine. On the eastern, or Swiss side, it is steeper and more precipitous than on the western side, where it consists of a series of parallel minor chains which gradually sink down to the valley of the Doubs. It is traversed by the railways to Lyons; Pontarlier, Fort de Jour; Besançon; to Belfort by Mulhausen; to Belfort by Delle and Porrentruy; and by the roads Geneva, Fort L'Ecluse, Lyons; Geneva, St. Cloud; Geneva, Fort les Rousses, Salins, Besançon; Bienne, Porrentruy, Belfort; and Basle, Porrentruy, Blamont, Besançon.

Thus the hill-range is difficult to cross, very defensible on the French side, as Suchet found in 1815, and with indifferent lateral communication until the valley of the Doubs is reached. Uniting it with the Vosges is the low range of the Valdieu Hills, separating the Rhine and Rhone basins, and extending from Porrentruy to Giromagny. In the middle stands Belfort, guarding the road, canal, and railway to Mulhausen, and closing a gateway for the invasion of France, which has been utilized by Ariovistus, the Huns, Charles the Bold, and Turenne. The Faucilles Hills which unite the Valdieu Hills with the plateau of Langres are steep, abrupt and defensible towards the north, but easier and more undulating on their southern slopes. The calcareous plateau of Langres slopes more or less gently towards the westward and the valley of the Seine, is much wooded and badly traversed by roads everywhere, and has steep and often precipitous slopes on its eastern side towards the valley of the Saone. It offers a very strong second line of defence against invasion from the eastward; and, as Manteuffel found in

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1871, its paucity of roads renders combined operations difficult and dangerous. Langres itself, a strongly fortified town, is the key to the plateau. It will further be noticed that the majority of the river lines between the plateau of Langres and the Jura, such as the Doubs, the Loire, the Oignon and Saône, run parallel to the Swiss frontier; thus emphasizing the importance in first line of Belfort, closing the Valdieu gap, and of Besançon, covering the approaches from the Jura. Behind these places, respectively, Langres and Dijon, with Auxonne, Gray, and Vesoul in advance, are of considerable strategical importance, closing as they do the approaches to the valleys of the Seine and Loire.

Turning to the right centre, or Alsatian, section of the frontier, we find it marked as far as Mount Donon, near Strasburg, by the southern Vosges which separate the valleys of the Rhine and the Moselle. Composed, unlike the Jura, of granitic or porphyritic rocks, they form a formidable military obstacle to any advance across them; but when once passed the country becomes less difficult, and the sources of the Meuse and Moselle are soon reached. None the less there are several minor roads across this difficult country, but the most important are those from Mulhausen to Epinal, Schlettstadt to S. Dié, and Colmar to S. Dié.

In Alsace the only important tributary of the Rhine is the Ill, which runs parallel to the mountains as far as Strasburg. Mulhausen, near its source about Belfort, is the junction of the railways to Paris, Basle, and the Lower Rhine, and is the key to the Alsatian Canal, and of the roadways that extend up and down stream. Schlettstadt in this valley has been dismantled as a fortress since 1871; but the Germans insisted on keeping within their frontier the plateau of Saales in 1870, as being the meeting point of five roads to Strasburg, Senones, Raon l'Étape, S. Dié, and Villé.

As before pointed out, the frontier line bends backward from Mont Donon in the direction of Blamont and Vic; and it is from this point that the physical weakness of the new frontier, as compared with the old, first shows itself. The open undulating land through which run the upper courses of the Moselle, the Meuse, and their affluents is more passable than the loftier range of the Vosges, or than the same streams further down in Lorraine. The land behind Mont Donon is still high, often wooded, marshy, and, except in the valleys, sparsely cultivated; but none the less it is weak militarily without fortified *points d'appui*. Any movement, however, either of offence or defence in this area between Mont Donon and Toul passes a series of defensive lines marked in a rough parallelism by the Meurthe, the Moselle, and the Meuse.

The Meurthe is rather too near the frontier for the chief defensive line, but still offers valuable positions for checking a rapid inroad from Schlettstadt or Strasburg.

Below S. Dié it is more passable and less favourable for defence; but at Blamont on the Vezouze watching the next great roadway over the Vosges by Saverne and Saarburg, as well as the roads north, by Saarbruck and Saargemund, a strong defence could be made on the S. Jean plateau.

In advance of this again are two other positions, facing, as the rest do, north and north-east, the one closing the Blamont-Saarburg road between the ponds at Voucourt, S. Georges, and the Upper Saar, and the other in rear of the Sanon, and marked on the right by the forest of Paroy, the centre by the hills of Serres, and the left by Dombasle. This latter place is the pivot on which any retreat of a French right wing behind the Meurthe would be based. It is at S. Dié, behind the right wing of this general defensive line, that the now notorious hut-barracks have been constructed, though there are many other places too that have been doubtless equally well provided. A glance at the map will show a sparsely populated district where the can-

tonment of a large body of troops in bad weather would be difficult. No more innocent precautionary measure could have been taken than that of constructing between S. Dié and Remiremont, at the tiny hamlets of Bruyères, Corcieux, and Gérardmer, about the sources of the Morgne, a tributary of the Meurthe, hut accommodation for the troops that may have to defend the district. Remiremont is almost the right of the chief line of defence along the Upper Moselle. The river is easy of passage to Epinal, the junction of eight roadways where it is crossed by three bridges, and below this again to Charmes, bridges are numerous; but from that place to Bayon there are none. Between Bayon and Pont St. Vincent, the stream is easiest to cross and bridge, and at this point the Madon joins it.

On the Moselle the strongest positions for defence are at Flavigny, Charmes, and Epinal, behind which on the "mountains of Mirécourt," the watershed between the Madon and the Moselle, are Haroué and Mirécourt, the keys of the defence of this section of the river.

Nancy on the Meurthe, the capital of Lorraine, is the centre of the roadways of the Province, and has a good position for defence behind it on the Haye plateau, but it is not from its situation a naturally strong place.

The mountains of the Meuse that, from the southward, have hitherto followed the left bank of that river, sink at Commercy to form a gap beyond which the range again rises to form the Argonnes Mountains; while the eastern bank is occupied by the Lorraine Hills which also form a gap between Nancy and Commercy, which is closed by the fortress of Toul on the Moselle. It was always a fortified place of importance, but is now more so than ever, as closing the principal and easiest line of invasion of France from Germany.

Frouard, at the junction of the Meurthe and Moselle, is also of extreme value in this section of the French frontier, inasmuch as disaster on the Meurthe would involve the abandonment of the whole of the east bank of these rivers and of the railway from Strasburg by Nancy to Metz. It is too near the frontier to be made of first importance, but it is an important outpost none the less.

Behind this principal line between Toul and Epinal lies finally the line of the Meuse itself, the most defensible points on which are Pagny (at the edge or *lisière* of the great forests there), Vaucouleurs at the head of many defiles, Maxey, and Neufchâteau.

From Pagny and Neufchâteau roads lead back to Vitry and to Bar-sur-Aube, and forward to Nancy, Toul, and Epinal.

Thus this right-centre section of the French frontier is fairly strong, owing to the nature of and parallelism of the material obstacles; and as far as possible the weaknesses have been mended by fortifications with the object of checking the approaches by way of—

1. Saint Avold—Nancy—Saint Dizier.
2. Saargemund—Luneville—Joinville.
3. Zweibrücken—Blamont—Chaumont.
4. Strasburg—Saint Dié—Epinal—Langres.

The left centre section from Toul to Verdun has next to be considered with regard to offensive movements directed due westward from the mid-Rhine. In this area the obstacles, chiefly rivers, run parallel to the frontier, roughly speaking, but the district is rich, passable, and abounds in good roads. Moreover by this section lies the shortest road to Paris.

At both Frouard and Pont-à-Mousson are strong advanced positions covering these passages of the Moselle; and from them are roads to S. Mihiel and Commercy which eventually lead to Chalons. In addition to these, there is a fair road uniting S. Mihiel to Metz.

This small section S. Mihiel—Commercy (with its forest in rear) is of grave

importance, and has been strongly fortified. In front of the Meuse is the position of Bouconville (where the roads to Pont-à-Mousson and Frouard unite), supported in rear of either flank by those of Gironville (to the south) and Apremont (to the north).

Between S. Mihiel and Verdun the river is less passable; but the latter place, commanding the junction of many roads and railways, has been strongly held, and has a good defensive position in front.¹ The ground between the Meuse and Moselle opposite this left-centre section of the frontier is open, and there are no successive positions proposed to be taken up as there are in the Meurthe Valley; while behind the Meuse, that is to say on the left rear of Verdun, extends the large and difficult forest of the Argonnes. In front of this continues the valley of the Meuse by way of Stenay, Sedan, and Mézières, opposite the neutral territories of Belgium and Luxemburg, the main passages over which are closed by old fortified towns in some cases slightly improved by modern outlying works.

On this side these river-lines, such as the Meuse, Aisne, Marne, &c., and the hill ranges, such as the Argonnes, bend westward, and therefore present those obstacles again roughly parallel to an invasion from the north-east. By Stenay, Longwy, Luxemburg, and Treves lies the shortest road to Coblenz, and an advance into France by this line not only "turns" the Meuse and Moselle defences, but menaces the flank and communications of French armies in motion against the Saar.

In front of the new frontier line the Vosges separate the Rhine valley from that of the Moselle. The Seille and the hill-ridges east of it afford difficult ground for a French advance north of Nancy, unless the fortress of Metz, on the flank of such a movement, is blocked. Strasburg, on the other side of the Vosges, is less to be feared at first, then Metz. Railways unite Nancy with Saar-Albe, and Remilly with Saarbarg. The ground of the Southern Palatinate offers few distinct advantages to either belligerent, who must perforce utilize the river valleys of the Moselle, the Saar, the Nahe, the Rhine, or the roads leading from Saarbruck, by Kreuznach, or Saarbruck, by Kaiserslautern, to that bend of the Rhine in which Mainz lies.

The country is hilly, wooded, and intersected. The Rhine Valley is easy for German movement because of the roads and the fortresses that command them. To the French it offers a difficult road of approach, crossed by many small streams, affording strong positions for defence, and cramped between the hill land of the Vosges and the river, where the fortresses dominate its banks far inland from the stream.

It will be seen, therefore, how much the belt of debatable land now extending between France and the Rhine has strengthened Germany. The defensive capabilities of the Bavarian Palatinate are in no sense weakened, but have been added to by the possession of Metz and Strasburg. The Saar, Seille, and Neid are only physical obstacles to German movement. Beyond these river lines and the steep hill land, it has in front of it, on the whole, a more easily penetrated country than the French would have, from their side, and the permanent right of passage of the principal frontier stream, the Moselle, at Metz.

The new frontier of France depends on artificial, not natural strength, and on the fighting power of its men. While Germany in an advance from the Rhine has behind it the difficult and defensible hill land, and before it the more open undulations of Lorraine, France, in taking the offensive, has easy ground for her first operation, but with every step in advance would find the physical and military difficulties increase.

The delimitation of the new frontier left France very open between Givet

¹ Bassin du Rhin (Pichat).

and Belfort. It was essential to rapidly fortify this gap, and great exertions have been made, and successfully, to do so.¹

In first line are the four entrenched camps of Belfort, Epinal, Toul, and Verdun, covering respectively the *trouée* of Belfort, the Upper Moselle, and the Meuse.

In second line are the entrenched camps of Besançon (behind Belfort), Langres (behind Epinal and Toul), Dijon (behind Besançon and Langres), Reims (behind Toul), and Laon (behind Verdun).

In third line are the entrenched camps of Paris, Lille, and Lyons.

Taking these in order :—

Belfort has a double line of detached works,² the inner one formed by those which formed the external defences in 1870, and which were somewhat close to the enceinte ; and an outer one formed by the forts of Giromagny, Roppe, Salbert, Barres, Miotte, Justice, Hautes and Basses Perches, Chèvremont, Bosmont, Vezelois, Sévenans, Meroux, Bourogin, Bermont, Dorans, Botans, Pérouse, Mont-Vaudois, Côte, and Bellevue. In the extreme south is Fort de la Chaux, which protects Montbéliard and unites it by Fort Montbart with the battery of Roche and Fort Lomont, which cover the valley of the Doubs.

North of Fort Giromagny is the battery of Planche, which with Forts Ballon de Servance, Château Lambert, Rupt, Parmont, and Arches guard the course of the Moselle as far as Epinal.

The entrenched camp at this place is formed by the Forts of Bambois, de Razimont, La Mouche, Longchamp, Dogneville, Uzeguey, Sanchey, Girancourt, Roulon, and Friches.

It is in front of this section that the wooden barracks,³ about the construction of which so much political capital has been made, have been grouped, though there is little doubt that in the neighbourhood of the other frontier fortresses and "Forts d'Arrêt," where the barrack accommodation is deficient, the same principle of providing temporary shelter for troops has been followed. Thus huts have been erected at Gerardmer (for its garrison of 3,000 men, covering as it does roads at Remiremont, Ramonchamps, Münster, and Vatin), S. Dié (which also contains 3,000 men), Corcieux, Bruyères, and Nancy. Bruyères is also an important junction of roads to Epinal and S. Dié, and covers the road between the two places. If, as is reported, the 4th battalions of the frontier regiments are being drafted to Verdun and Toul, to act as garrison troops, there would be all the more need for providing additional shelter there and elsewhere. The 4th battalions, now serving in Algeria, are also to be recalled to France.

Between Epinal and Toul there are few if any works ; but the latter place has been strongly fortified as being the centre of the great tactical and strategical position covering the road and railway from Paris to Strasburg, as well as the Marne and Rhine Canal.

The left of the position is covered by a fort at Frouard, the right by another at Pont S. Vincent. Toul itself occupies the centre of the arc, and is surrounded by forts at Villay le Sec, Dommartin, Chaudenay, Mont S. Michel, Ecrouves, Domgermain, Blénod, Justice, and Tillot. Two works at Manonvillier form an advanced post.

¹ The French class the new works under two heads by "Entrenched Camps" and "Forts d'Arrêt," which are small isolated works mutually aiding each other by their fire or commanding certain roads and approaches, but none of great size.

² These practically follow the line of heights occupied by the German line of investment in 1870-71.

³ Asserted by German press writers to be capable of containing 100,000 men, but this is highly improbable.

Works of less importance (Forts d'Arrêts) guard the Valley of the Meuse at Lucey, Trondes, Gironville, Liouville, S. Mihiel, Troyon, and Gemicourt.

Speaking generally, permanent works from 3 to 5 miles apart extend from S. Mihiel on the Meuse to Pont S. Vincent on the Moselle, a front of about 32 miles.

Verdun is the place of next importance, covering the Metz-Chalons roads and railways. The town is surrounded by a bastioned enceinte, outside which and enclosing a considerable area are forts at Haudainville, Rozellier, Maubois, Bellrupt, Déran, Moulainville, Eix, Tavannes, Danloup, Vaux, Souville, St. Michiel, Belleville, Marre, Chaume, Regret, Belleray, Landrecourt, and Dugny.

The valleys of the Lower Meuse and Cheir are only guarded by the old fortresses of Longwy, Montmédy, Givet, &c., with small works at Mont d'Hairs, Vignes, Condé, Mézières, and Charlemont.

The fortresses in second line are the entrenched camps of Besançon, Dijon, Langres, Reims, and Laon. Besançon is surrounded by Forts Chaillux, Châtillon, Calvaire, Patente, Griffon, Beauregard, Montfaucon, Buis, Fontain, Rolland, Planoise, Rosemont, Chaudanne, Ferme, Chaumont, Mont Boucon, and Justices.

Auxonne, which is also fortified, joins Besançon to Dijon, which is surrounded by Forts Varois, St. Apollinaire, Sennecey, Beauregard, Mont Affrique, Motte-Giron, and Hauteville.

Langres is an old fortified place surrounded by Forts Sainte-Menge, Dampierre, Plenoy, Peigney, Chemin de fer, Franchises, Montlondon, Cognelot, Mont, Marnotte (commanding the railways to Vesoul, Gray, and Dijon), Bonnelle, Buzon, Brévoines, Pointe-du-Diamant, and Nid de l'Aigle.

A small fort at Vitry-le-François unites Langres with Reims, which is surrounded by forts at Loivre, Brimont, Cran, Vitry, Berru, Nogent, Pompelle, Mombé, Mont Joly, Patis, Vrigny, Chenay, and Pouillon.

From Reims to the Belgian frontier are Forts Condé, east of Soissons; Malmaison, Montberolt, Carrière, Bruyères, south-east of Laon; the citadel of Laon with Forts Morlot and Classen; La Fère surrounded by works at Verigny, Mayot, Vendeuil, Liez, Jussy, and Noureuil; the old fortress of Rocroy and the Fort of Hirson.

In third line are the three great entrenched camps of Lyons, Lille, and Paris.

The citadel of Lyons is surrounded by works at Sathonay, Vancia, Serme-naz, Calvire, Montessus, Tête d'Or, Charpenne, Brotteaux, Villeurbanne, Hirondelles, Lessigaz, Bron, Petit-Parilly, Corbaz, Feyzin, Vitriolerie, Colombier, Motte, Champvillard, Montcorin, Côte Lorette, Clos-Roux, Brussin, Montcelard, Sainte Irénée, Sainte Foy, Lovasse, Vaise, Saint Jean, La Duchère, Freta, Monton, Norcel, Carrières, and Mont-Verdun.

Lille is the centre of the northern district, and its old fortifications have been converted into an entrenched camp by the addition of the chain of works formed by the Forts of Bondues, Mons-en-Barœul, Triez, Lionderie, Saint Maurice, Camp-Français, Sainghin, Henneitières, Lesquin, Seclin, Houplin, Arbrisseau, Haubourdin, Englos, Prêmesques, and Vert-Galant.

It forms the centre of a circle of older fortresses such as Cambrai, Valenciennes, Landrecies, Quesnoy, Condé, Bouchain, Douai, Arras, St. Omer, linking therefore on the left with the Dunkerque-Calais works, and on the right with Maubeuge, whose old citadel is surrounded by the forts of Grevaux, Leveau, Sarts, La Salemagne, Boussois, Rocq, Cerfontaine, Bourdieu, and d'Hautmont, with other smaller works between the enceinte and the outer line.

Paris is the principal redout for the defence of France against an invasion from the east. The city itself is enclosed with a bastioned enceinte, outside

which is the double row of works at Corneil, Cotillons, Montlignon, Domont, Blémur, Montmorency, Ecouen, Moulin, Butte-Pinçon, Stains, St. Denis, Est, Vanjourns, Montfermeil, Chelles, Aubervilliers, Romainville, Noisy, La Boissière, Rosny, Fontenay, Nogent, Vincennes, Noisiel, Villiers, Champigny, Sucy, Limeil, Villeneuve, Château-Gaillard, Charenton, Faisanderie, Gravelle, Ivry, Hautes-Bruyères, Bicêtre, Montrouge, Vanves, Issy, Châtillon, Palaiseau, Châtaignerie, Terrier, Gatinés, Igny, Bièvre, Villeras, Haut-Buc, Désert, Docks, Bouvier, Satory, St. Cyr, Bois d'Arcy, Ru-de-Gally, Marly, La Vauberderie, Champ-de-Mars, Glacière, Arches, Reservoirs, and Mont Valérien.

To guard the frontier, all the French War Ministry seem to have put into line are the VIth and VIIth Corps, whose headquarters are at Chalons and Besançon, on a peace footing with an independent cavalry division at Luneville. This arm is always kept up to full strength either in peace or war. Another complete brigade is reported to be under orders for Epinal, probably from the VIIth Corps.

But enormous sums have been spent in the hope of strengthening the new and weak frontier by fortifications; and the total expenditure has been estimated from 702,073,000 francs to as much as 1,300,000,000 francs. Toul alone is said to have cost 20,000,000, and Paris 58,000,000 francs.

Turning to the German defensive preparations their general plan has been to strengthen and extend the defences of the Rhine, but with the exception of Metz, which protects the passage of the mid-Moselle, the old Alsatian and Lorraine fortresses have been abandoned.

Thus of Bitsche the walls have been destroyed and the citadel alone remains; Saarlouis, an old bastion-traced fortress with a hornwork serving as a *tête-de-pont* to the stone bridge over the Saar, is retained unchanged. As Saarlouis is commanded on the east by the Lemberg Heights at a distance of 3,000 yards, and on the south by the Emsberg Heights at a distance of 1,500 yards, it is probable that this important passage of the Saar will also be surrounded in case of war with detached forts of a temporary character, which with the inundations that can be easily made would make the place sufficiently strong.

Thionville has been little altered since the war. It is a strongly fortified place on the bastioned system of Cormontaigne's school, with a large hornwork on the right bank of the Moselle. This has been partly cleared and demolished to form a store *depôt* and large railway station; and as during the war of 1870 the city was at the mercy of batteries placed on the Guentrange Hills, about 2,500 yards distant on the left bank of the river, and those of Illanges, 1,500 yards away on the right bank, it is hinted that temporary works will be constructed to prevent the recurrence of a bombardment which might destroy valuable stores.

It is a point of considerable importance, being at the junction of the lines from the Ardennes, Metz (two), S. Avold, Treves, and Luxembourg. It is of the more importance now that the line from Treves to Cologne is open; but nothing special has been done to it except to improve the bomb-proof accommodation.

Metz, strongly fortified before the war though the works were incomplete and only partially armed, has been much strengthened since it has been in German hands. The old enceinte with its advanced works still exists, and the encircling forts have been finished and improved. Beginning from the north,¹ and italicizing those of original French construction, which were of a bastioned trace, these are:—Manteuffel (formerly *S. Julien*), Zastrow

¹ In each case the outlying works will be named in order from the north round by east to west with the hands of a watch.

(formerly *des Bordes*), Gûben (formerly *Queuleu*), Württemberg (formerly *S. Privat*, between the Metz and Seille, a flat, lunette-shaped German redoubt), Fort Prince Frederick Charles (a large combined work overlooking the Gravelotte plateau, and formed of the old French work *S. Quentin*,¹ in front of which is a German polygonal redoubt united to *S. Quentin* on both sides of the hill by a strong parapet), Alvensleben (formerly *Plappeville*), and Kammeke and Hendersin (situated near Woippy and St. Eloy on the Moselle below Metz).²

The perimeter of the entrenched camp so formed is about 13 miles, but the line of investment, which must be beyond the reach of the heavy fortress guns, is much longer.

Metz not only covers the lines of French invasion on Treves and Saarbruck, but is the head of the Argonnes railway system.

The importance of Strasburg has enormously increased. Before the war the town itself, situated on the left bank of the Rhine, did not afford a protected passage across the river though a bridge existed there, for the right bank at Kehl was German, and the first act of the war was the blowing up of this bridge by the German commander. Now, however, both banks are German, and the fortifications that enclose Kehl and Strasburg have not only made a vast entrenched camp of the place, but have made of them a "double bridge-head," giving the power of operating on either bank of the stream.

The enceinte is an old bastioned trace, with a citadel and outworks on the east reaching near to the river. On the north side this has been removed to admit of the extension of the town. Kehl is protected by Forts Blumenthal, Bose, and Kirkbach; and it has been proposed to construct another work at Diersheim about 8 miles below Strasburg on the right bank, to link the fortress with that of Rastadt. Strasburg itself is covered by Forts Fransecki (on the Ill below the town), Werder (on the same river above the town), Von der Thann, Prince Royal of Saxony, Prince Bismarck, Grand Duke of Baden, Prince Royal, Roon, and Moltke. Of these, Fransecky, Thann, and Werder only have wet ditches. These outworks are united by parapets for infantry, have a railway running in rear of them from flank to flank, and have underground telegraphic communication with the city. The Rhine is crossed by a permanent railway bridge and one of boats, and a new railway links the fortress with Gernersheim by way of Seltz.

The line of the Rhine from Switzerland to Holland is now German, and all the principal passages are closed by important fortresses. In order from the south these are Neu Breisach, Strasburg, Rastadt, Gernersheim, Mainz, Coblenz, and Cologne, and in addition there are other points where there are fixed, floating, or flying bridges. The first of these latter is at Huningen, just above which a fixed bridge (provided with mining chambers) carries a railway uniting those which run along each bank of the river; and a few miles below are favourable points of passage at Kems, Rheinweiler, Bellingen, Neuenberg, and Markt. At Neuenberg, where the German Reserve Division crossed to besiege Schlettstadt, is a boat bridge.

Neu Breisach (left bank) is dominated by Alt Breisach, and is an old

¹ These German redoubts are, as a rule, of the same pattern. They are rhomboidal, with the front face bent outward so as to form a five-sided figure. The rear face is covered by a small reduit.

² Forts Manstein, Kammeke, and Hendersin are lunettes with Grûson turrets. West of Montigny and elsewhere are about seventeen or eighteen epaulments for batteries between the forts covering the intervening ravines. The advanced works of the old enceinte called Forts *Bellecroix* and *Moselle* have been re-named Steinmetz and Voigts-Rhetz.

fortress on the bastioned system. A railway crossing the Rhine on a fixed bridge unites Colmar with Freiburg in the Black Forest.

Between Breisach and Strasburg are foot bridges at Markolsheim, Scheinau, Rheinau, and Gerstheim.

Strasburg has been already described, and possesses a boat bridge, and a fixed railway bridge; while below it, at Gamsheim, Drusenheim, and Maxau, are bridges, the last-mentioned of which carries another cross line uniting Carlsruhe (right bank) with Windden. Germersheim on the left bank is Bavarian, constructed on the polygonal system, and from its position forms another bridge-head for the passage of German troops. The town itself, surrounded by an enceinte, has a small work covering the bridge, and two redoubts on the right bank; and forming an arc resting on the Rhine are five other polygonal advanced redoubts, on the left bank, the three central and most important of which are named Forts Frederick, Wrede, and Deroy. A fixed railway bridge has been made here for another cross line from near Carlsruhe to the left bank. Though thus surrounded by detached works, the space within is too constricted for Germersheim to be classed as an important entrenched camp.

Below this place the Rhine is difficult to cross (though it could be bridged in places owing to the marshy nature of the banks), so that the next point of passage is at Spire, on the left bank, where there is a boat bridge. It was at Spire, Germersheim, and Maxau that the 3rd Army, commanded by the Crown Prince of Prussia, crossed the Rhine in 1870.

Mannheim, on the right bank, belongs to Baden, and is at the confluence of the Neckar with the main stream, and is faced by Ludwigshafen, with which it is joined by a boat bridge and a railway bridge conveying a line to Mainz.

It was the base of supply of the 3rd Army in 1870, and in addition to being of considerable strategic importance, is the limit of the ordinary steam-boat navigation of the Rhine; but it is at present unfortified. From it extend lines to Frankfort, Wurzburg, Nordlingen, Stuttgart, Ulm, Rastadt, Neustadt, Kaiserslautern, Saarbruck, Germersheim, Weissenburg, Strasburg, and Mainz.

There is a boat bridge lower down at Worms, and favourable points of passage, though not bridged, at Oppenheim and Germersheim. It was at the latter place Gustavus Adolphus crossed the river in 1631.

Mainz, at the junction of the Main with the Rhine, is a strongly fortified town on the left bank, and the river, which is here 600 yards wide, is crossed by a boat bridge. This is covered on the right bank by a bridge-head of bastioned trace, assisted by Fort Montebello down stream, and by Forts Kostheim and Mainspitze on either bank of the Main. The islands of Petersau and Ingelheim also contain works covering the approaches from the lower reaches of the river.

On the west bank the town is surrounded by a continuous bastioned enceinte, beyond which is a double line of works, the inner line of which contains Forts Charles (south of the city), Italien, Elizabeth, Philip, Joseph, and Hauptstein (with an advanced work to the north). The outer line contains Forts Weissenau, Heilegenskreuz, Hechstheim, Marienborn, Zahlbach, Bingen, and Gonsenheim; but as these are rather close to the place, it has been proposed to construct others still more advanced on the Haidenberg (west), the Bornberg (south-west), and a third near Hechtshausen (south).

There is an enormous establishment here for the preparation of preserved meats and biscuits, which are utilized in peace-time for the fleet and garrisons. It was the base of the 2nd Army in 1870, and is one of the most important strategic centres of the Rhine, and the key to the valley of the Main. Here crosses, on an iron bridge, the railway from Darmstadt, meeting

that from Frankfort, and lines to Coblenz run on either bank of the river ; every preparation has been made on these lines for the rapid debarkation of troops.

Thence the river, running between the Taunus and Hardt mountains, is difficult to cross until Bingen is reached ; here the Nahe joins the main stream, and the Strasburg-Neustadt and Saarbruck-Kreuznach lines run into the left bank railway. The banks still continue steep and precipitous below Bingen, but at Bacharach is a point of passage which was utilized in 1793 by the Prussian Army, and another at Caub, which was used in 1814. A little further down the Lahn enters the Rhine on the right bank, its valley being occupied by the Wetzlar-Giessen-Cassel railway, which here joins that on the right bank.

Coblenz-Ehrenbreitstein, the next important fortress, is situated at the meeting of the Rhine and the Moselle, the former river being crossed by a boat bridge and the railway joining the river bank lines, and the latter by the left bank railway to Cologne. From this latter a railway follows the line of the Moselle and Saar to Treves.

The fortress of Ehrenbreitstein, on right bank, is an almost impregnable citadel, crowning a lofty hill facing the Moselle. It is strengthened on the south by Fort Atertein, in advance of and on the east of which are three small advanced works, thus covering the approaches on this side. Coblenz itself is enclosed by a bastioned enceinte, to the south-west of which on a commanding height is Fort Alexander, with two advanced works, supported by Forts Constantine and Bücher. The ground in front of these is mined. Between the Moselle and Rhine, below the city, is a group of works of which Fort François is the centre, and beyond which are five others, the chief of which (Bubenheim and Nauendorf) face down stream. All these advanced works are of polygonal type.

Coblenz is the station for the ironclad fleet of gunboats employed in the defence of the river. The vessels, twelve in number, are defended by 0.07 inches of iron, and are armed with two 12-cm. guns in a revolving turret. Their war crew consists of sixty sailors and fifty infantry men, and their speed is about 9 miles an hour ; but while they can be employed only with the greatest difficulty beyond Mainz, they would be chiefly useful in guarding the lower reaches of the stream between Bonn and Holland. The country is difficult below Coblenz, and there is no permanent passage, except a flying bridge at Bonn, until Cologne is reached.

This, the last of the really important German Rhine fortresses, is crossed by a boat and permanent railway bridge, and is the point of concentration of all the French, Belgian, and Dutch lines which lead to Northern Germany. From it also runs a line to Treves.

Both the suburb of Deuz and the town of Cologne are surrounded by a continuous bastioned enceinte (the latter double), and in front of that at Deuz are four large lunettes forming an arc resting on the river. Cologne itself has a double line of works also forming a semicircle, and resting on the Rhine, the inner group of which (800 yards from the place) consists of nine large lunettes, closed at the gorge, 200 yards in advance of which are eight smaller lunettes. As the extreme front of the entrenched camp is only about 5 miles, it has been proposed, and partly carried into effect, to construct at about 3 miles from Cologne an arc of three large and nine small forts, assisted by seven large and seven small batteries in between, which would give ample space. There would also be four of the larger works covering Deuz, and eight on the left bank. There is little of military interest in the river until the Dutch frontier is reached, the only important places being Neuss, which is peculiarly defensible, and is on the left bank ; Dusseldorf, on the right bank, where the Rhine is crossed by a boat and a fixed railway bridge, covered by

a small bridge-head ; Linn again crossed by a bridge ; Ruhrort, with two bridges ; and Wesel, a fortified town, on the right bank. It is surrounded by a bastioned enceinte, but has lost much of its former strategic value. The Rhine is more easily crossed below Cologne than above.

Omitting the garrisons of the fortresses on the lower Rhine, Alsace and Lorraine at present appear to be occupied by the following troops :—

Metz	67th, 98th, 92nd, 130th, 131st, and 4th and 8th Bavarian Regiments, and 19th and 13th Dragoons, 2 regiments field artillery, 2 batteries horse artillery, $\frac{1}{2}$ regiment fortress artillery.
Strasbourg	25th, 47th, 99th Regiments, 15th Uhlans, and 2 field artillery regiments, 6 companies fortress artillery.
Neu Breisach	105th Regiment, 2 companies fortress artillery.
Mulhausen	17th and 112th Regiments.
Thionville.....	70th Regiment, 6th Dragoons, $\frac{1}{2}$ regiment fortress artillery.
Colmar	126th Regiment, 14th Dragoons.
Weissenburg ..	60th Regiment.
Saverne.....	8th Battalion Jagers.
Haguenau.....	11th Battalion Jagers, 15th Dragoons, and 2 field artillery regiments.
Saarburg	7th Uhlans and 5th Bavarian Light Horse, and 2 batteries horse artillery.
S. Avold	14th Uhlans.
Saarlouis	2 batteries horse artillery.

None of the infantry regiments and only a few of the artillery batteries are on a war footing.¹

The armed strengths of the frontier nations that may be involved in a Franco-German War are somewhat difficult to arrive at, the accounts, on the French side at least, being very conflicting. It would be impossible moreover to enter into much detail, and it must be sufficient therefore to give approximately the total numbers. France adopted after the war the territorial system of Germany though not in its entirety. German recruits are really localized even to companies, but the French conscripts are not so recruited, but are, possibly for political reasons, drafted to regiments or corps at a distance from their homes ; the reserve of the active army and the territorial army are posted to depôts in their own neighbourhood. Thus, though theoretically the French and German systems are similar, there is an important and serious element of difference between them. As the French conscripts are not localized but serve in regiments away from the district in which they live, they would not as a rule when called in from the reserve rejoin the regiment in which they had been previously trained. The bond of union therefore that exists between the German reservist and the regiment to which he throughout his entire service belongs is wanting in France. While the German joins a force, on mobilization, in which he is sure to know his comrades and his Officers more or less, the French soldier has all this to learn when his corps is mobilized. This must produce a temporary friction which time alone can alter, and of which in modern war there is little enough to spare.

The Army is divided into two groups, the field army and the territorial army, each of which has its reserve ; but it does not appear that the latter has any permanent organization in peace higher than the regiment. The

¹ From French sources it appears that the asserted German garrison in the provinces is 16 regiments of infantry (48 battalions), 3 battalions of rifles, 11 regiments of cavalry, 2 regiments of field and 6 batteries of horse artillery, not counting the troops at Treves, Carlsruhe, Rastadt, Mannheim, &c.

field army is organized in corps, each of 2 Divisions of 2 brigades of 2 regiments of 3 battalions (the fourth battalion of each being for the fortresses), with 1 battalion of Chasseurs-à-pied, 8 divisional, and 8 corps, and 1 reserve batteries of artillery, 1 cavalry brigade of 2 regiments and 1 battery, with the usual auxiliary services. It numbers 38,335 Officers and men, with 108 guns. "Independent" cavalry Divisions of 2 brigades of 2 regiments with 3 batteries of horse artillery are also organized.¹

To absorb her large force of available troops, France is divided into eighteen "regions" each of which contains an army corps, and to this must be added the 19th, an Algerian Corps, which is also available for use in case of a European war, a local Division in Tunis, and an army corps in Annam and Tonquin. The following table shows the distribution of this force.

No.		Headquarters.	Divisions.	Infantry Brigade.	Cavalry Brigade.
1	Lille	1. Lille	Lille	Cambrai	Lille.
2	Amiens	2. Arras	Arras	St. Omer	
3	Rouen	3. Amiens	Soissons	Beauvais	Compiègne.
4	Le Mans	4. Compiègne	Givet	Sedan	
5	Orléans	5. Paris	Paris	Paris	Evreux.
6	Châlons-sur-Marne	6. Rouen	Rouen	Caen	
7	Besançon	7. Le Mans	Saval	Le Mans	Chartres.
8	Bourges	8. Paris	Paris	Paris	
9	Tours	9. Paris	Paris	Paris	Vendôme.
10	Rennes	10. Orléans	Auxerre	Blois	
11	Nantes	11. Nancy	Nancy	Verdun	Commercy.
12	Limoges	12. Rennes	Mézières	Troyes	
13	Clermont	13. Chaumont	Belfort	Chaumont	Gray.
14	Lyon	14. Besançon	Lons le Saulnier	Lyon	
15	Marseilles	15. Dijon	Dijon	Lyon	Dijon.
16	Montpellier	16. Bourges	Bourges	Nevers	
17	Toulouse	17. Châteauroux	Châteauroux	Paris	Tours.
18	Bordeaux	18. Tours	Tours	Angers	
19	Algeria	19. Rennes	St. Brieux	Rennes	Dinan.
		20. St. Servan	Cherbourg	Paris	
		21. Nantes	Nantes	La Roche-s-Yon	Nantes.
		22. Vannes	Paris	Lorient	
		23. Limoges	Limoges	Paris	Limoges.
		24. Périgueux	Angoulême	Brives	
		25. Lyon	Lyon	Lyon	Moulins.
		26. St. Etienne	St. Etienne	Roanne	
		27. Grenoble	Grenoble	Chambery	Valence.
		28. Lyon	Lyon	Gap	
		29. Nice	Toulon	Bastia	Marseilles.
		30. Avignon	Mines	Privas	
		31. Montpellier	Montpellier	Rodes	Carcassonne.
		32. Perpignan	Perpignan	Albi	
		33. Montauban	Agen	Cahors	Montauban.
		34. Toulouse	Toulouse	Auch	
		35. Bordeaux	La Rochelle	Bordeaux	Libourne.
		36. Bayonne	Mont de Marsan	Pau	
		1. Algiers			
		2. Oran			

¹ "Avant la Guerre."

The territorial army which is assigned to the same regions also consists of the "three arms," there being at present 145 regiments of three battalions each organized, or at the rate of about eight regiments per region. There are also about one regiment of artillery, about eight squadrons of cavalry, and a proportion of engineers and auxiliary troops to the same areas. The total "paper" strength, given in the most favourable statement regarding the French Army, therefore stands thus :—

1st Line (field).....	708,030 men.
" ".....	2,034 guns.
Further reserves	758,068 of all arms.
2nd Line (territorial).....	482,500 men.
" ".....	1,682 guns.
Further reserves	1,104,273 of all arms.

The actual number of field guns, horsed, is 2,694 ; but there are said to be 6,000 available guns in store.¹

As in Germany the French now mobilize their corps in their several "regions," and do not, as in the last war, seek to actually build up their armies on the frontier within striking distance of a vigorous enemy.

The French concentration on the frontier would naturally be chiefly in two great groups, the one at about Belfort to the south and the other about Verdun, Toul, and the Donon. The front of the latter as the crow flies is about 75 to 80 miles.

The lines for effecting this concentration are ten in number.

1. Calais—Lille—Hirson—Mézières—Sedan—Montmédy.
2. Le Havre—Rouen—Amiens—Laon—Reims—Mézières—Sedan—Verdun.
3. Cherbourg—Caen—Evreux—Asnières—Argenteuil—Saint Denis—Chantilly—Senlis—Crépy—Soissons—Reims—Sainte-Menehould—Verdun.
4. Brest—Rennes—Le Mans—Versailles—Paris—Epernay—Chalons—Nancy.
5. Nantes—Tours—Vendôme—Paris—Nogent-sur-Seine—Troyes—Chaumont—Pagny—Nancy.
6. Bayonne—Bordeaux—Poitiers—Tours—Orléans—Etampes—Juvisy—Villeneuve Saint Georges—Melun—Joigny—Nuits-sous-Ravière—Châtillon-sur-Seine—Chaumont—Neufchâteau.
7. Tarbes—Auch—Agen—Périgueux—Limoges—Moulins—Nevers—Autun—Dijon—Langres.
8. Foix—Toulouse—Figeac—Aurillac—Clermont—Moulins—Chagny—Dijon—Vesoul—Epinal—Rambervillers.
9. Perpignan—Montpellier—Mines—Avignon—Valence—Lyon—Châlon—Besançon—Vesoul—Belfort.
10. Saint-Jean-de-Maurienne—Chambery—Bourg—Besançon—Montbéliard—Belfort.

When the order to mobilize is given each corps is placed on a war footing in its own district before it is moved to the front, thus copying, in its entirety, the German plan. There are four or five magazines of stores in each corps region. The corps is to be mobilized in six days, which are to be utilized as follows :—

- 1st day. Lodge and clothe the mobile companies, &c.
- 2nd day. Arrival and disposal of reservists.
- 3rd day. Stores and equipment issued.
- 4th day. Distribution of arms and ammunition.
- 5th day. Route-march for a few miles.
- 6th day. Formation of regiment.

¹ Expenditure on artillery since 1871 = 1,240,000,000 francs.

Thus on the 7th day the army would be ready to concentrate; and on or after that day the Vth and VIIth Corps and two cavalry Divisions would be on a war footing on the frontier. At the same time the Ist, IIInd, Vth, VIIIth Corps and the other independent cavalry Divisions would be ready to move to the front, and two days later might be massed with the Vth and VIIth, bringing reinforcements of 200 battalions, 250 squadrons, 950 guns. On the 10th day the remaining corps, with the exception of the XIXth, would be concentrated at the places assigned to them.¹

Meanwhile the territorial army would be mobilized and would appear at the depôts on the 7th day as soon as the other troops had advanced. The general centres of concentration can be gathered from the direction and convergence of the greater railway lines. All French writers agree that Germany not France must produce a *casus belli*, but when that occurs the action of the French armies should be immediately offensive.²

The rolling stock required per corps is 102 trains, of from forty to sixty-six carriages with a single engine (if light), or fifty to fifty-six carriages with two engines (if heavy, with stores or matériel as well as men). This would require for the corps, 138 engines and 4,440 carriages; or for the nineteen corps, 2,622 engines and 84,360 carriages. As the Eastern Railway Companies of France alone possess 6,000 engines and 200,000 carriages, there is no want of carrying power. The organization of the German is similar to that of the French, consisting of a field army with its reserves, and a second line composed of reserve Divisions and Landwehr troops. But while the army corps on a peace footing contain a cavalry brigade, these, on mobilization, are formed into independent cavalry Divisions, each of 3 brigades of 2 regiments, with 3 batteries of horse artillery.

The Army Corps on a war footing therefore consists of 2 Divisions of 2 brigades of 2 regiments of 3 battalions, with 8 divisional and 8 corps batteries of artillery, 2 regiments of divisional cavalry, besides the usual auxiliaries. It numbers 57,189 Officers and men, with 96 guns.³ The Army is distributed as follows :—

¹ Judging from the recent experimental mobilization of the 17th Corps, there seems every reason to believe that the French have not exaggerated their asserted readiness for war. The 1st day of mobilization was the 31st August, and by the 3rd the reservists had all joined, raising the corps from 10,000 to 36,759. On the 8th day the corps was fully mobilized.

² The "Almanach de Gotha" gives the French Army as 24 corps in 1st Line and 8 in 2nd Line. These extra 5 corps in 1st Line must be formed from the reserves of the 1st Line, for which there seems to be no present organization.

³ "Foreign Armies."

Corps.	Province.	Head-quarters.	Commanders.
Guard	Prussia ..	Berlin	Gen. von Pape. ¹
I	Prussia	Königsberg	Lieut.-Gen. von Kleist.
II	Pomerania	Stettin	Gen. von Dannenberg.
III	Brandenburg	Berlin	Lieut.-Gen. Count von War- tensleben.
IV	Saxony	Magdeburg	Gen. Count von Blumenthal
V	Posen	Posen	Gen. von Stiehle.
VI	Silesia	Breslau	Lieut.-Gen. von Wichmann.
VII	Westphalia	Münster	Gen. von Witzendorff.
VIII	Rhenish	Coblenz	Lieut.-Gen. Baron von Lcö.
IX	Sleswig-Holstein	Altona	Gen. von Tresckow.
X	Hanover	Hanover	Gen. Prince A. of Prussia.
XI	Hesse-Cassel	Cassel	Gen. Baron von Schlotheim.
XII	Saxony	Dresden	Gen. Prince G. of Saxony.
XIII	Wurtemberg	Stuttgart	Gen. von Schachtmeier.
XIV	Alsace and Lorraine	Strasburg	Lieut.-Gen. von Hendusk.
I Bavarian ..	South Bavaria	Munich	Gen. Baron von Horn.
II Bavarian ..	North Bavaria	Wurzburg	Gen. von Orff.
Hessian Division	Hesse	Darmstadt	Lieut.-Gen. Prince Henry of Hesse.

The second line is formed of eighteen reserve infantry Divisions.

The apparent total force at Germany's disposal amounts therefore to—

1st Line (field).....	821,123 men.
2nd " "	2,040 guns.
2nd Line (reserve Division and Land- wehr).....	449,700 men.
3rd " " " " " "	— guns.
3rd Line (Landsturm and depôt and garrison troops)	1,307,725 men.

The nine German lines that in 1870 led to the Rhine have been much added to and improved since that date.

Thus Hamburg and Hanover, Oldenburg and Osnabruck have been directly joined. A line runs almost direct from Berlin to Giessen and another from Berlin to Darmstadt. Leipzig has been joined with Nurnberg whence Rastadt can be easily reached; and numerous other small cross lines have been or are being constructed uniting the main arteries so as to feed them with troops and hasten the mobilization.

¹ These Officers occupied the following commands in 1870 :—

Pape, 1st Infantry Division Guard Corps.

Von Kleist, Inspector-General of Engineers, Headquarters.

Count von Blumenthal, Chief of Staff, III Army Corps.

Von Stiehle, Chief of Staff, II Army Corps.

Von Wichmann, Chief of Staff, II Army Corps.

Von Witzendorff, Chief of Staff, VIII Army Corps (Cavalry).

Von Tresckow, Adjutant-General, Headquarters.

Prince Albert of Prussia, 2nd Cavalry Brigade Guard, Cavalry Division.

Baron von Schlotheim, 25th Cavalry Brigade, IX Army Corps.

Prince George of Saxony, Commander 23rd Infantry Division, XII Army Corps.

Still the general tendency is, omitting the network of lines in the trading district of Wesel, to concentrate behind the river between Coblenz and Strasburg.

Thus, when the concentration in the Rhine valley is complete, the armies can advance from the river towards the French frontier by eleven lines, instead of the four that were practically at their disposal in 1870. These are :—

1. Cologne—Düren—Enskirchen—Bittburg—Treves—Thionville.
2. The line of the Lahn—Coblenz—Trarbach—Treves—Saarlouis.
3. Bingen—Kreuznach—Neukirchen—Saarbrück—Metz.
4. Mayence—Alzey—Kaiserslautern—Homburg—Neukirchen—Saarbrück—Saargemund—Saaralbe.
5. Mannheim—Neustadt—Kaiserslautern—Homburg—Zweibrücken—Saargemund—Saarburg.
6. Mannheim—Neustadt—Weissenburg—Hagenau—Bitsche—Saargemund.
7. Kinzig railway—Strasburg—Saverne—Saarburg.
8. Freiburg—Breisach—Colmar—Mulhausen.
9. A new line will cross the the Rhine above Huningue; it turns the canton of Basle by Schopfheim and will join the Danube lines without touching Switzerland.
10. Gernersheim (fixed bridge over Rhine), Landau—Zweibrücken—Saargemund.
11. Mannheim—Gernersheim—Lauterburg—Saverne.

As a matter of fact in 1870 it required eight to ten days for the infantry, three to eight days for the cavalry, and three to eight days for the artillery to be brought to a war footing, and one main line was assigned for the transport of each corps; but strenuous efforts have been made since to reduce the period. All gaps in the Officer Corps are filled up from the reserve; 1,990 were called out in 1870 with 11,279 Landwehr Officers.

But there are other armies besides those of France and Germany which may be directly or indirectly concerned in another war for the Rhine. These are the Armies of Switzerland, Belgium, and Holland, through whose territories either by land or water it is possible, in case of dire necessity, one or both of the greater belligerents might be induced to pass. Doubtless little resistance could be offered while the violating army was in full vigour and successful; but beaten back routed, there might be another tale to tell.

The Swiss Army is practically a militia, every citizen owing personal service to the State. It amounts to :—

1st Line, infantry.....	113,884 men.
" cavalry	3,000 "
" artillery.....	300 guns.
2nd Line (Landwehr)	202,000 men.
" 	500 guns.
" 	42,000 horses.

This latter force exists only on paper, but the Federal Council has quite recently decided to "at once" organize the Landwehr.

The fortifications of the country are insignificant. There are none on the western frontier, only the old fort at Schaffhausen on the northern, and fort Luzienstieg on the eastern frontier. But it has been proposed from time to time to construct permanent defences to cover Basle; to protect bridges over the Aare, Reuss, Limmat, and Saane; to guard the railway junction at Olten, and provide a central "place of arms" at either Berne or Zurich.¹

¹ Journal U.S.I., vol. xxv.

These places may therefore be deemed of strategic importance.

On the other flank of the frontier the only danger of the violation of Dutch territory lies in the forcible occupation of the lower Rhine by gunboats from the sea to meet those placed by Germany on the upper reaches of the stream. There would be no object in invading Holland proper, and Luxemburg has ceased to be of interest to the Dutch. It is scarcely probable therefore that Holland would interfere in a great struggle for the Rhine valley. At the most she might protest; and laying the country between the Zuyder Zee and the Rhine under water, and also the district south of the stream round Willemstadt, she might concentrate her forces within the works of the "new water line" between Naarden, Utrecht, Gorkum, and Gertruidenburg, and of the "south water lines," about Willemstadt and the Islet of Overflakkee, formed by the inundations referred to, and for which every preparation has been made. To pass into the river, gunboats would have to run the gauntlet of the works at Brille, Helvoetsluis, Willemstadt, Gertruidenburg, Workum, and Gorkum; and if troops were landed to silence the works there they would probably be opposed.

To meet such a case there is a field army of three Divisions, giving a field strength to the Dutch army of about 65,000 men; or, including the second line, or "Schuttery," a total force of about 150,000 men and 120 guns.

Belgium occupies a more dangerous position than Holland; for an easy road either to France or to the lower Rhine lies within her territories. Such a movement, if conducted along the eastern bank of the Sambre and Meuse, would after all utilize but a small portion of the Belgian Kingdom. Of course, theoretically, it is the same as the occupation of the capital of the country; practically, it is nothing of the sort. Though her neutrality is guaranteed by the Great Powers of Europe, she none the less has raised an army respectable in numbers and discipline; and when mobilized for war, in which case the Garde Civique, organized in companies and battalions during peace, is added to the regular forces, she has an effective total of—

Infantry.....	142,000 men.
Artillery.....	300 guns.
" reserve	800 "

These are to be distributed in two groups—

- (a.) The field army of 2 corps, of 2 Divisions, of 2 brigades with an independent cavalry Division = Infantry 56,000 men.
Cavalry 7,000 "
Artillery 240 guns.
- (b.) The Army of Antwerp of 1 Division, of 2 brigades =
Infantry 44,000 men
Artillery 800 guns.

The remainder would be distributed among the frontier fortresses and garrisons. With the exception of the older fortresses, which the experience of the campaign of 1870-71 proved to be not as a rule of much modern value, the only "strong place" in Belgium is Antwerp, which, fortified on "polygonal" principles and surrounded by detached works, has been made by General Brialmont one of the strongest fortresses in Europe. On this, to all intents and purposes, the practical defence of Belgium would at present rest. It has been proposed to strengthen the approaches to the Antwerp lines by works at Lierre, Malines, and Termonde, places which would cover the inundations that would be made, and perhaps eventually entrench the camp at Béverloo.

The *tête-de-pont* on the Scheldt at Termonde has been retained, as well as

the citadel (only) of Namur, and two small forts near Liège. But the possibility of having to safeguard other portions of her territory has been recognized. M. Beernaert, Minister of Finance, has this year introduced a Bill to improve the armament of the Belgian infantry, and states that it appears "*necessary that the fortifications of Liège and Namur should be transformed and extended.*" Thus at Liège there are to be two works on the right bank, at Fleron and Tieff (at the confluence of the Ourthe), and two on the left bank on the heights of the Aus. The forts along the Meuse are to be at Huy, where the Meuse enters the river; on the heights of Bouge opposite the citadel of Namur, and at Erpent. This anxiety for the safety of the valley of Meuse can scarcely be directed only against France.

Taking into consideration the value of the present frontier, the relative strength of the belligerents, and the conduct of the last war, the following conclusions may be arrived at:—

A glance at any map which shows the theatre of war in France during 1870-71 will show how very small a portion of the country was actually held by the invading forces, and how everything finally hinged on the submission of the capital.

The Germans, fully aware of the unprepared condition both of the French Army and of the frontier fortresses, took the offensive directly their concentration was completed, and having gained the line of the northern Vosges by the frontier battles of Spichern and Woerth, pushed forward with the greatest rapidity, defeated or enclosed army after army, and within a few weeks had invested Paris. Having done so, they took every precaution to prevent the siege from being raised by the raw levies that were being formed in the undisturbed districts north of the Somme, south of the Loire, and west of the Sarthe and Huisne.

Now that the German frontier line has been pushed so much further westward, and within marching distance of districts far less encumbered with formidable physical obstacles than were offered to the three armies that crossed the Saar and Lauter to meet the French Corps in 1870, it is a question rather difficult to decide as to whether a similar plan of operations under modern conditions would reap results as great as those gained in the last Franco-German War.

The premises on which any argument should be based are threefold: (1) the condition and mobility of the French regular and territorial armies; (2) the possibility of again bringing the war to a conclusion by the capture of Paris; and (3) the nature of the frontier both as regards its offensive and defensive capabilities.

The first of these premises must of necessity be matter of conjecture on paper, and theoretically, the Army of France is stronger, in every arm save cavalry, than that of Germany. Her artillery is heavier and better, and with better organization may achieve results as great as the German massed batteries at Woerth or Sedan. The French have never been technically inferior in artillery work to the Germans, and they may have attained a tactical equality since last they measured swords for the Rhine. They have seen the folly of matching batteries of machine-guns against field artillery, and have a powerful mass of heavy batteries with each army corps fully organized and equipped in peace for use in war. They seem incapable, however, of preparing for possible hostilities without referring mysteriously to some new and wonderful thing which of itself is going to alter the whole complexion of modern fighting. Last time it was the mitrailleuse which was to do wonders and didn't. Useful in its proper place, it in no one way influenced the fate of any single fight. Now there is to be a melinite shell which is to be so peculiarly destructive that none shall stand before it. Doubtless men's nerves are capable of being shaken; but those German

guardsmen who mounted more than once that blood-stained slope of St. Privat are not easily frightened however severe the loss; and many a gallant French battalion showed a bravery and devotion far too brilliant to be cowed merely by projectiles however deadly. Loss will be greater doubtless, and brave men will stand it as they always have, to whatever nationality they belong. Repeating rifles on the one side and melinite shells on the other will be faced with just the same courage with which the Chassepôt met the needle-gun, and *vice versa*, just seventeen years ago. Men, skill, and science win battles now-a-days; weapons, provided there be reasonable equality between the combatants, influence battles but little.

In one point Germany must for many years maintain a superiority. Her military machine is of no recent origin. It has been perfected as far as possible in peace, put to the test in two great wars, after which every weakness that had evidenced itself was attended to and remedied. It is the German Staff, the German leaders, and the German Officers of all grades which render the military strength of Germany formidable beyond mere numbers. The commanders of the German army corps are men of tried and ripe experience in the leading of great units in still greater armies which previous training had taught to work to a common end. West of the new frontier there are no men with the reputation of those who, on the other side, would, on the declaration of war, lead their corps to concentration with a confidence that knowledge of what to do, and exactly how to do it, can alone give. France requires the hard-won lessons of another war to prove her new men and her new military machine. Germany does not need it. If on the one side, therefore, there is the greater strength of numbers, and even superior armament in some cases possibly, on the other there is an experience which training in peace, however careful, however exhaustive, can only partially initiate.

(2.) The possibility of bringing a war to a conclusion by the capture of Paris is less than heretofore. So strong is the capital now, so extensive its ring of forts, that it is beyond the power of any modern army to invest it and at the same time keep a considerable force for field operations. In 1870 it was only possible because the bulk of the regular troops of France were prisoners, interned in the neutral States, or invested in weak fortresses. Taken by surprise, beaten successively in every encounter, nothing was left for the scattered fugitives but to fall back upon the fortress of the capital.

It is scarcely likely that such a sudden collapse of the defensive strength of France will occur again. Beaten she may be on the eastern frontier, but only after a more desperate struggle than the last, and rout is less likely to occur than seventeen years ago. Even in falling back, if she be compelled to, Paris is strong enough to stand alone; and the retreat to southern France behind the Loire covers the greater part of her territory, protected somewhat on the right by the entrenched camps of Belfort, Besançon, and Lyons, which are too formidable to be easily passed by. A movement in pursuit would attenuate the German lines of communications and expose their right flank, not to a weak army weakly based, like that of Faidherbe, but to a strong and better organized force based on the entrenched camp at Lille, or even Paris herself.

The numbers on both sides are so far equal as to render such a course as this dangerous, to say the least, for the invader.

A second investment of Paris, if it were possible, would be scarcely likely to meet with the same results as when Gambetta raised his "armed men" for its defence. The present condition of the capital, if all else were lost, points to a much more prolonged struggle, the end of which none can foresee.

(3.) The nature of the frontier, as far as its geographical condition is concerned, has been already referred to, as also have the military precautions

taken to mend it. But from the French point of view it presents four points for consideration:—

1. On the extreme left it faces Belgium.
2. The centre faces the Palatinate and Lorraine, whose flanks are guarded by Thionville, Metz, and Strasburg.
3. The right faces the Vosges and Jura, behind which lies Switzerland.
4. The extreme right is separated by the Southern Alps from Italy.

The maritime Alpine section may be left out of the question. Whatever understanding there may be between Germany and Italy, there is little real animosity between the latter and France. The remembrance of the campaign of 1859 must still awaken a kindly feeling, even though Napoleon's success stopped at the Venetian Quadrilateral, and was rewarded by the cession of Savoy and Nice. "Everything comes to him who waits," and Italy knows that well. Neutral in every respect, and possibly "observant" if the war reached near her frontiers, she might reasonably call it a "benevolent neutrality" if France were victorious, and, if otherwise, point out to the conqueror that she had taken only the usual military precautions in cases of non-intervention. It would not be worth Italy's while to open up a blood feud with her neighbour France by assisting Germany.

Switzerland is somewhat differently situated. To either belligerent she, or her territory, would be of possible value. To Germany its possession would relieve her from the danger, possibly remote though still a danger, of an invasion of the Southern States by the passage of the Rhine between Basle and Schaffhausen. To France it would enable her to turn the left of the whole of the Rhine defences; and though, doubtless, she does not at present mean or desire to do so, in case of a prolonged desperate struggle in the valleys of the Rhine and Moselle in which neither combatant was gaining a decisive advantage, it might offer the only possible doorway for a French offensive return against German territories. There has always been a cordial feeling too between the Swiss and French Republics; a feeling strengthened by the kindly treatment of Bourbaki's army when interned in Switzerland. But the dire necessity of war might induce France to propose, and even get Switzerland to agree, under protest, to permit the "right of way." There would be, and need be, no threat of annexation; pivoted on Besançon and Belfort, and availing itself of the line Berne—Geneva—Lyons for supplies, the communications of a French army would be completely covered.

None the less such a course would be undoubtedly avoided if possible, and would only be adopted in case of pressing need.¹

Turning to the other flank of the frontier, there is the question of Belgium. As seen by the map there is an easy approach from the Sambre and mid-Meuse to the Lower Rhine, by way of Aix-la-Chapelle, on Cologne and Dusseldorf. Such a line of advance would again turn the flank of the great fortresses of the Rhine, would penetrate Hanover, a State that even now is believed to form part of Prussia with considerable reluctance, and open the road to Berlin. The command of the sea might be of some value to a French invading army in such a case; but only if it could act offensively against one or more of the fortified seaports and estuaries, and either open up a new base of supply or disturb the estuarine cities.

But to France such a course is full of dangers. Let alone her friendship with Belgium—based on community of feeling, religion, and language—the

¹ A recent article in the "*Avenir Militaire*" points to the recent development of German strategic railways in the direction of the Upper Rhine, but this would seem to indicate precautionary defensive measures rather than offensive. The strongest part of the French frontier physically and otherwise is that opposite the Southern Vosges and Jura.

violation of her territory would rouse antagonistic feelings in more than one European State whose policy otherwise would be that of non-interference.

Neither Belgium nor Holland, both of whose territories would be exposed, would act offensively, probably, though they might mobilize their armies and protest. They could do little else, however much inclined. Whatever be the condition of the French Army, it is immeasurably superior to anything King Leopold can put into the field. The field army of Belgium would scarcely venture to actively oppose the levies of the Republic. Sheltered behind the forts of Antwerp it would be safe, and would maintain the independence of that portion of Belgian soil, and hence eventually of the State of which it forms a part. Belgium would protest, and that is all. Neither section of the Pays Bas, neither Belgium nor Holland, would be so ill-advised as to try to measure their earthen pitchers against the greater brazen vessels swimming in the same dreadful stream of war.

But any effort to get round the strong line of German Rhine defence on the part of France is, certainly as a primary movement, open to serious objection. To turn the flank of a vast entrenched frontier line is a different proceeding from that of turning the flank of a small defensive position. It means a long and dangerous operation, let alone the impolicy of the violation of neutral territories, and in her case, with Germany so strongly posted opposite her weakest frontier and nearer the heart of France than she was before, she would expose her line of communications to danger if the covering force left to check and engage the Germans in Lorraine were defeated and driven back on Paris. This is more apparent in the movement from the north against the German right than in the south against the German left.

In the latter, the advance would cover the line of supply on Lyons, while Belfort would secure another along the Doubs; but in the former, France would, from her frontier to the Lower Rhine, be marching parallel to her enemy's territory on the one side, with a possibly unfriendly neighbour on the other behind the Meuse.

To attack either flank of the Rhine defence, too, would concentrate, not separate, the German strength. To invade Bavaria and Wurtemberg from Switzerland would but drive the allies back to mass behind the Maine. To traverse Hanover from Belgium would be but to meet the strength of Prussia backed by the Southern States. Both plans would cause delay, and such delay would enable the German hosts to concentrate for battle. Even if the advance across the Lower Rhine succeeded, the occupation of Berlin is of little value. It is not the centre of national political life that Paris is or was. It is but one of the capitals of a Confederation. The destruction of the armies of that Confederation, not the holding of a city, would terminate the war. Placing a French garrison in every town in Prussia need not bring about an armistice so long as there are armies to be beaten in the field.

It is not probable therefore that any effort will be made on the part of France, at first, if at all, to move against the Upper or Lower Rhine. Assuming that both armies mobilize with equal rapidity, the one behind the Rhine, the other behind the Argonnes, and that both concentrate at the same time, there is little doubt but that, if possible, France will take a vigorous offensive. The occupation of the neighbourhood of Belfort protects the right flank, and threatens a movement through Alsace on Strasburg between the Rhine and Vosges, as soon as territorial troops can form on the Doubs in second line. A German attack on this flank would have to meet this Army of the South.

Everything will depend on the result of the first great collision somewhere between the Palatinate and the Moselle. Metz can be watched and passed by as Strasburg can be "contained" from Belfort; and the remainder of the French Army would be free to advance into Lorraine when their place

would be occupied by the corps of the territorial or second line. The dash of taking the initiative, the patriotic appeal to the sentiment of regaining and reoccupying the lost provinces once more, would all appeal to the strongest sympathies of France. All would depend on this first move; all future plans would centre round the result of the first great battle. On neither side would there probably be any delay in seeking to test each other's relative strength. And what beyond that? It is hard to say.

The plan that Napoleon III proposed of appealing to the religious or political sympathies of the Southern States of Germany against the northern is as dead as Queen Anne. Irrespective of the fact that the last war blood-linked the Empire, time has forged the bond still stronger, and the units of Imperial Germany will have nothing to do with Republican France. If the French were successful in the Palatinate it might still prove possible to force the Rhine with a victorious army, and operating by Mainz and Mannheim along the Main separate the armies of the Confederacy by main force. If, on the other hand, there is prolonged fighting and indecisive results in the Palatinate, then it is possible that an attempt to invade Germany from Belfort might be tried. If this failed, or if victorious west of the Rhine but unable to pass that river, then, and then only, might France attempt the passage of the Lower Rhine. The next war will be a life and death struggle between two great nations, in which the rectification of a frontier, or the possession of a river, will seem trivialities. All depends on that first move and that first great battle between the Moselle and the Saar.

The first dispositions proposed are to station 2 corps in Paris, 1 each in Lyons and Belfort, and place 15 corps in line (inclusive of that from Algeria) in three armies—

Left—On the plateau of Bouconville, occupying Apremont, Gironville, and Pevenelle, in front of Commercy.

Centre—On the plateau of Hayes (near Nancy).

Right—On the plateau of Rambervilliers.

This very arrangement indicates a wish to actively defend, if need be, the gap between Verdun and Epinal; or, if possible, to advance straight into the lost provinces against the line of the Saar. Assuming the garrison of both Metz and Strasburg to be each 1 corps, and subtracting from the French force 2 corps on either flank to watch them, there would still be left 11 army corps in first line to try the ordeal of battle.

As in 1870, but with a better chance of success, a diversion might be threatened by the fleet with a corps of marines and marine artillery on the coast of the Baltic, or the North Sea, and prevent, as it did in the early part of the last war, the immediate transference of every corps to the Rhine frontier. In the above estimate, only the corps of first line are included. Behind them are the organized cadres of at least half as many corps again, which in a very short time indeed might be available for field service, and the protection of the frontier.

But supposing Germany were ready to move first, and did so. She might act defensively towards the Meurthe; and, striking westward, form front of battle from Nancy to the north, and attack the fortifications and positions of the mid-Meuse.

The general line of French resistance in such a case is suggested to be from Frouard to Longuyon, the position in front of Verdun and Commercy (at Bouconville, &c.), being the key of the defence. Echeloned in left rear of this line is the forest of the Argennes, with the flank protected by Hirson, Mézières, and Montmédy, and with Soissons in second line. If driven from this the left wing would fall back to the position between the Aisne and Marne, somewhere about Compiègne and Château-Thierry, with the object of still further retreating to the south-west on Montereaux.

Accompanying this movement, or, if the first attack were delivered not against Verdun—Toul, but south-west against the "Meurthe front," and were successful, the right wing at Epinal would utilize a series of positions which have been selected, though all of them could scarcely be occupied. These are, if possible :—

1. In front of the Seille at Baronville and Morange.
2. Across the Seille from Pont-à-Mousson by Amélcourt to De Morville, and so to the heights of S. Georges.
3. Behind the Seille, from Nancy, by Serres to Réhicourt and S. Georges.
4. Behind the Sanon, from Dombasle to Blamont.
5. Behind the Vezouze, from Dombasle.
6. Behind the Meurthe, from Dombasle, Rambervilliers, to Bruyères.

All these pivot on Toul and the occupation of the Hayes plateau behind Nancy.

7. Behind the Moselle, from Toul and S. Nicholas, by Bayon and Charmes to Epinal and Remiremont.
8. Behind the Madon, from Toul by Haroué and Mirécourt to Epinal and Remiremont.
9. Behind the Meuse, by Liouville and Commercy, to Vaucouleurs and Neufchâteau.

The right flank of these last positions would be somewhat protected by the works on the Upper Moselle and the Faucilles Mountains, with Langres in second line. This latter entrenched camp would be the pivot of the further retreat of this wing to the series of positions chosen further to the south-west. These are :—

1. The Haute Marne, about Joinville and Chaumont.
2. The Morvan district, on the upper Yonne about Autun and Clamécy, where the general line of defence of the entire frontier army would be from Montereaux on the Seine, supported by Paris, to Autun, supported by Dijon and Besançon.
3. The district of the Auvergne, "the reduit of southern France."

Practicable or not, this scheme of defence is advanced by French military writers of repute, and at any rate has a method in it very different from the ill-digested plans and preparations that characterized the French movements in the summer of 1870. The possibility of a check, of defeat that may necessitate a retreat into the heart of southern France, is at least recognized; and forethought has been exercised to determine what course should be pursued in such a case. Desirous though the French leaders may be to take the offensive at once and reap its elementary advantages and excite the enthusiasm such a course would arouse, they have learnt in the stern school of experience to be ready to meet reverse, while hoping to make a bold bid for victory. That very preparation and readiness will harden, strengthen, and make serious the temper of the armies of Lorraine.

The plans open to Germany are somewhat simpler than those of the French. The concentration of their armies further back from the frontier than that of France can be safely conducted without any fear of molestation under cover of the Rhine fortresses on either bank of the stream. The corps would be too well protected to be disturbed by the French cavalry, however dashing; while the German cavalry from both Metz and Strasburg might attempt, and with some success, to annoy the concentration of the French, which is more exposed to such enterprise.

The main railway lines at the disposal of the Germans for an advance from the base of concentration on the Rhine divide themselves into four groups :—

- R. { 1. Cologne—Treves—Thionville—Metz.
- { 2. Bingen—Saarbruck—Metz.
- { 3. Coblenz—Treves—Thionville.
- R.C. { 4. Coblenz—Treves—Saarlouis.
- { 5. Mainz—Kaiserslautern—Saarbruck.
- { 6. Mannheim—Kaiserslautern—Zweibrücken—Saargemund.
- { 7. Gernersheim—Landau—Deux Ponts—Saargemund.
- L.C. { 8. Mannheim—Neustadt—Haguenau—Bitsche—Saarburg.
- { 9. From the Kinzig—Strasburg—Saverne—Saarburg.
- { 10. Mannheim—Gernersheim—Lauterburg—Saverne.
- { 11. Friburg—Breisach—Colmar—Saverne (by Barr).
- L. Schoffheim—above Huningen to Mulhausen.

This points to a concentration of army corps on the

Right, at Thionville and Metz.

Right centre, Saargemund, Saarbruck.

Left centre, Saverne.

Left, Mulhausen.

The latter seems to be designed only as a check on Belfort; the two central armies, about two days' march apart, are, like those of France, in a position to defend the Saar, or advance vigorously with secure flanks on Nancy and Toul, the centre of the French defensive line. Allowing a corps each for the garrison of Metz and Strasburg, two corps (the 7th and 8th) for the right army; one corps (the 14th) to operate defensively on the left and watch Belfort, would leave 12 army corps for the central armies on the Saar, provided all could be called up from Germany.¹

The German "objective" will always be in addition to the primary consideration of the defeat of the armies on the frontier, the isolation of Paris to a greater or less degree as the political capital, and the separation of the French armies from the resources of southern France. This may be done by a movement either from the centre or left; but it is scarcely likely that, at first at any rate, any attempt would be made to act offensively from the Upper Rhine at Mulhausen. The physical difficulties there are considerable, the fortresses that close the roads and defiles far too important now to be passed with impunity. There is little room for the development of large armies until the mountain ranges of the Côte d'Or are passed.

The violation of Swiss territory would not help matters much. The débouchées from the Jura and towards Lyons by Geneva are difficult and guarded, and the delay to penetrate these in force would afford time for the concentration of masses sufficiently large to defeat in detail the divided columns. The defence based on Belfort, Besançon, and Lyons should be able to hold its own there, to say the least; and it might be materially aided by a vigorous offensive from Belfort against Mulhausen and the Upper Rhine.

At first, therefore, the German left wing would probably act defensively. The action of the central armies would depend on the preparedness of France. As she might, for reasons, chiefly political, aim at the valley of the Main, so as to strike at the joint between the States, as Napoleon did between the allied armies of Prussia and England at Ligny and Quatre Bras in 1815, and thus attempt to split in twain the Confederation, so Germany might, for military reasons only, attack first the centre of the frontier line of defence, in order to sever northern France from the south. Though in all probability numerically

¹ In 1870, one corps at least had to be left to watch the north coast line until all danger of a French descent there had passed away; now there might, in addition, be a necessity for leaving a corps or two on the eastern frontier of the Empire as well.

weaker than her adversary, she might seek to reap the advantage offered by the initiative, and attack the French in their long-prepared positions in front of Toul. The right flank would be guarded by Metz and the right wing, the left partially by Strasburg, but open to attack from the French Army of the South from Besançon, if it were strong enough to assume the offensive.

But there is another course open to her, and one that might be combined with a defensive attitude on the Saar, where the French might be entangled in the series of physical difficulties and strong positions that lie between the Moselle and Mainz. A movement might be made by the right wing, strengthened if need be at the expense of the centre, against the northern frontier line of France, so as to aim directly at Paris and the communications of the French Army with the capital; while the centre acting on the offensive-defensive, masked, or attacked the fortresses of Lorraine, or merely guarded the positions on the Saar.

It must be remembered, however, in considering this question that the present French plans are not based only upon a retreat westward. As before pointed out, North France, with Lille and Paris, can be left to take care of itself in case of disaster. It is southern and south-western France that forms the real base of supply of a French army, the real base of defence of the French land. A German movement from the north would be less fruitful of disastrous consequences to France now than in 1870, when the defence of France meant the defence of Paris. Doubtless it would turn the new lines of defence on the north-eastern frontier, and compel the withdrawal possibly of the armies that had moved into the Palatinate; but pivoting on the army of the south, either at Belfort and Besançon, or advanced to contain Strasburg, the French frontier army could fall back behind the Loire with little risk.

None the less an advance of the German right wing is more likely than a continued unsuccessful frontal attack against the fortified lines occupied by the bulk of the French army, even though an army invading thus from the north would be exposed to danger from a reserve army formed within the entrenched camp of Lille. It is true that Von Moltke stated that the German plan in the last war was marked by "an evident tendency to throw back the bulk of the enemy's forces to the north of their communications with Paris," and that, therefore, it may be advanced that similar reasoning would be used now. But conditions have changed. To separate North France from South was practicable enough when all the field armies were beaten, in full retreat, or disorganized, as they were then; it is different if they be able, as they might be now, to hold their own and not retreat at all. In such a case the frontal attack and the attempt to penetrate the centre of the defensive line might fail altogether. Doubtless a vigorous central attack on Toul, if the French gave them an opportunity, with the view of isolating both wings, and seizing Orléans as a first objective, would be attempted; and, if successful, a further advance might be made towards Orléans and the Loire, covered by an advance of the right wing from Thionville and the left from Mulhausen to "contain" Belfort and Besançon. But if such a plan failed from the beginning, the frontier defences may have after all to be turned, and there is only one flank which for physical reasons is really assailable, viz., that resting on Belgium. There are two methods of effecting such a movement, which probably would only be attempted if the Lorraine positions were found to be invulnerable and the German central army was compelled to fall back and act on the defensive. Both methods are such as to cover the lines of communication from French enterprise unless indeed the whole of the district west of the Rhine were in French hands, in which case the Germans would scarcely take the offensive at all. The attack on the French northern frontier implies a defensive attitude in the centre and the retention in German hands

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of the Palatinate. Any advance of a German army from the Lower Moselle and the Lower Rhine must be covered on its left by the high and difficult land of the Palatinate, and the flank exposed to Belgium is not likely to run any risk of an offensive movement against it.

Belgium might protest and mobilize, but would probably grant a temporary right of way none the less, as she would to France. Of the two, the least objectionable route, from the neutrality standpoint, is that based on the German right in Lorraine, *i.e.* :—

1. Treves—Thionville—Montmédy,
2. Treves—Luxemburg—Arlon—Longuyon,

both based on Coblenz, and aiming at Mézières, so as to turn the left of the forest of the Argounes. This would have to be coupled with the blockade of Verdun from Metz to protect the flank. The second and longer route, but even more secure and better provided with railways, is that based on the Lower Rhine at Cologne and Dusseldorf, for which three railways would be available.

1. Dusseldorf—Maestricht—Hasselt—Charleroi—Maubeuge—Compiègne—Paris
2. Dusseldorf—Maestricht—Liège—Namur—Charleroi—Hirson—Soissons—Paris.
3. Cologne—Aix-la-Chapelle—Liège—La Marche—Givet—Mézières—Reims—Paris.

So long as the line Thionville—Metz were held such a plan of operations would meet with little risk.

Whether the statement recently made by French writers that the northern frontier is as strong as the eastern is of course matter for conjecture, but, viewing the dire necessity of making the latter as far as possible safe, the northern defences, being older, are not likely to be stronger than those newly erected on the Lorraine Hills. At any rate this turning movement is improbable unless the frontal attack be proved impracticable, when there would be little else to do except to try another joint in the French armour of defence. It is not likely it would be made the first main attack because success here, unless coupled with a vigorous advance from Lorraine, would but drive the bulk of the field armies to concentrate south of the Loire. This northern movement, by itself and in itself, would not and could not disperse them.

If, however, victory attended the French arms from the beginning, and the Germans were compelled to fall back, there are strong positions along the Saar and Moder from Saargemund and Bitsche to Hagenau; again along the Saar and Queich, from Zweibrücken and Permasens to Landau; and lastly at Kaiserslautern between the Nahe and Spire. If, however, again defeated they retire behind the Rhine, the difficulties of the second campaign for the French would far outweigh those of the first. To cross that strongly-guarded stream would mean the blockading of fortresses holding garrisons so powerful that armies of several corps would be necessary to watch there and the immediate neighbourhood of the front passage of the Rhine selected for the invasion of Germany. All French and many German writers agree that the valley of the Main, either directly from near Mannheim or indirectly by way of the Upper Neckar Valley, would be the first objective. So much has this been recognized that it has even been proposed to construct a quadrilateral in this area, of which vast entrenched camps at Mainz, Hanau, Miltenburg (on the Main), and Mannheim should be the angles.

At present it is the only weak point in the strength of the mid-Rhine; with all its dangers, it might be less difficult to pass there than elsewhere.

For the French to essay the passage of the Black Forest between Strasburg and Mulhausen would be difficult and dangerous. To turn the same mountain district from Schaffhausen would violate the neutrality of Switzerland, and make a long, dangerous, and difficult line of communications for the invading army to guard. The passage of the Lower Rhine would also violate neutral territory, and so long as there was a single German force on the western bank of the river would again leave a line of communication still more risky than that through Switzerland, and exposed to be cut anywhere between the Meuse and Cologne. With Germany incapable of further offensive on the river such a plan as the advance through Belgium might be possible; but it would always be dangerous unless the French were absolute masters of the left bank of the middle Rhine, and even then would only be resorted to if the river-line were too strong to be forced.

Such seem to be the conditions under which the next "War for the Rhine Frontier" will be waged. It is a contest which both nations, without a shadow of pusillanimity, may reasonably and honestly dread. Neither can ever absolutely conquer the other now, and war would intensify the revengeful feeling that the last campaign engendered. How the feeling of increasing tension between Gaul and Teuton will end none can foresee. The tendency of both parties is to cry "peace" when there is no peace, and use hard words and draw invidious comparisons between each other's armies and nations. To what end? Has Germany the right to object to France strengthening with all her might a frontier that her adversary designedly made weak, while she herself has developed to the uttermost limits the fortresses that guard the Rhine? Are such stationary and permanent preparations purely defensive if they face westward, but wickedly offensive if they look the other way? Surely a little patience and some consideration would not be thrown away here. Has France a right to complain about a permanent increase of the Army of her ancient enemy when she herself has turned her entire Empire into one vast drill ground? She has a perfect right to do so, but so have other nations too.

Doubtless, as the "Cologne Gazette," not unnaturally perhaps, but with a curious contempt for what history has had to say about the value of treaties in the past, advances, Germany "desires the undisturbed validity of the Treaty of Frankfurt in word and deed, but the continued attacks on it which have prevailed since General Boulanger began to patronize such action constitute a standing source of alarm for both nations and for the peace of Europe."

Undoubtedly she wishes this treaty to be observed, but so probably at the time did some of the nations desire that of Ryswick should be maintained. Treaties are only valuable so long as both signatories will agree to keep them. Germany is not sinless in these matters; why should she seek to cast the first stone?

On the other hand, the Paris "Matin" points out that Germany "demands more than human nature can possibly grant when she expects the French to give up all hopes of recovering the lost provinces."

Germany must be blind to all the history of the world if she ignores, or pretends to ignore, this truism.

Furthermore, to expect that France with a weaker frontier, which Germany has forced on her, would not strain every nerve to safeguard it, would not fortify it to the utmost and essay to protect herself against a catastrophe similar to, if not greater than, that which befell her seventeen years ago, would be a greater strain on that same human nature than even to abandon her hope of being once more within sight of the Rhine.

Has Germany herself done nothing in Elsass and Lothringen? Has she reduced her garrisons or neglected her defences there?

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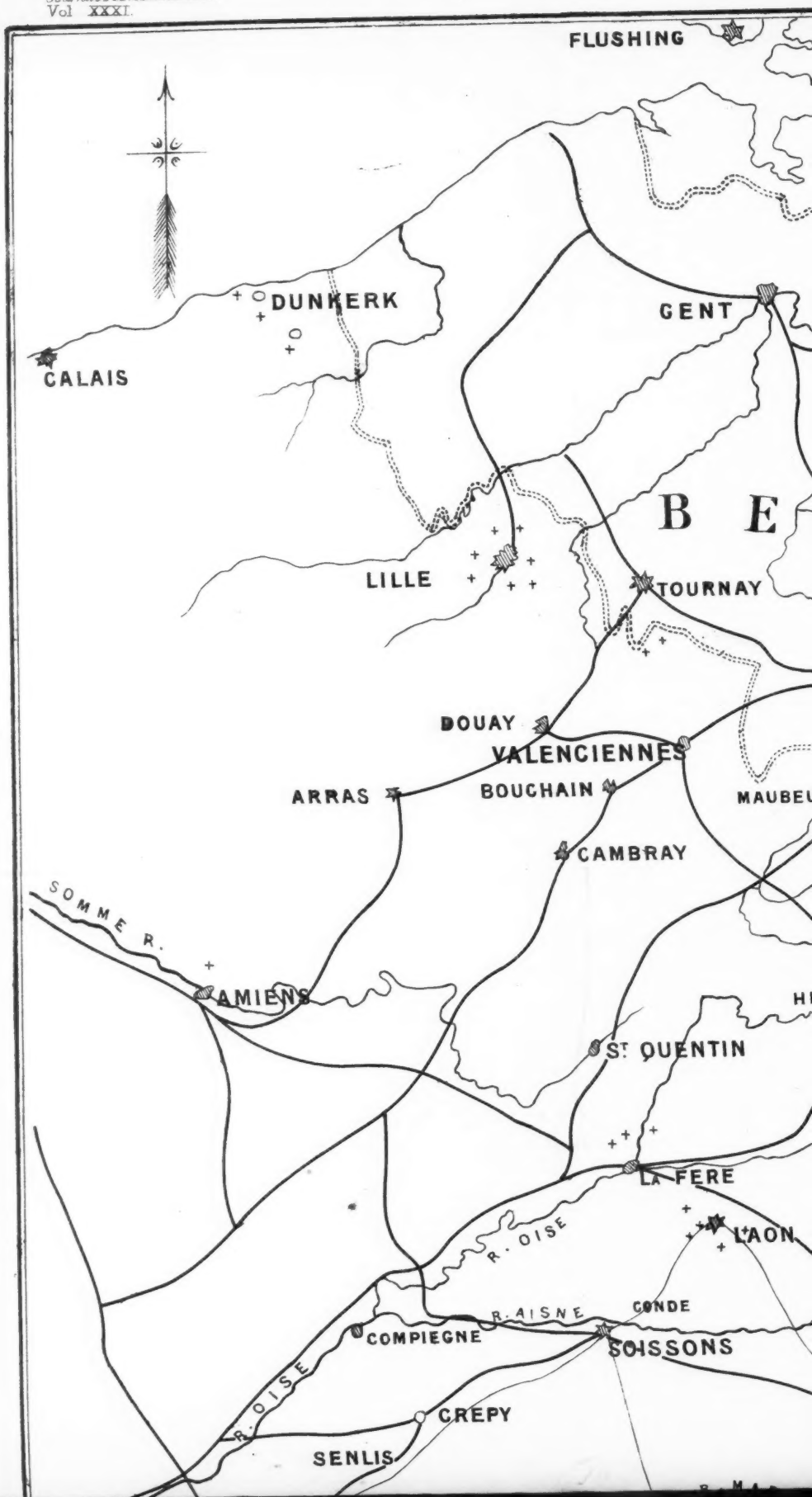
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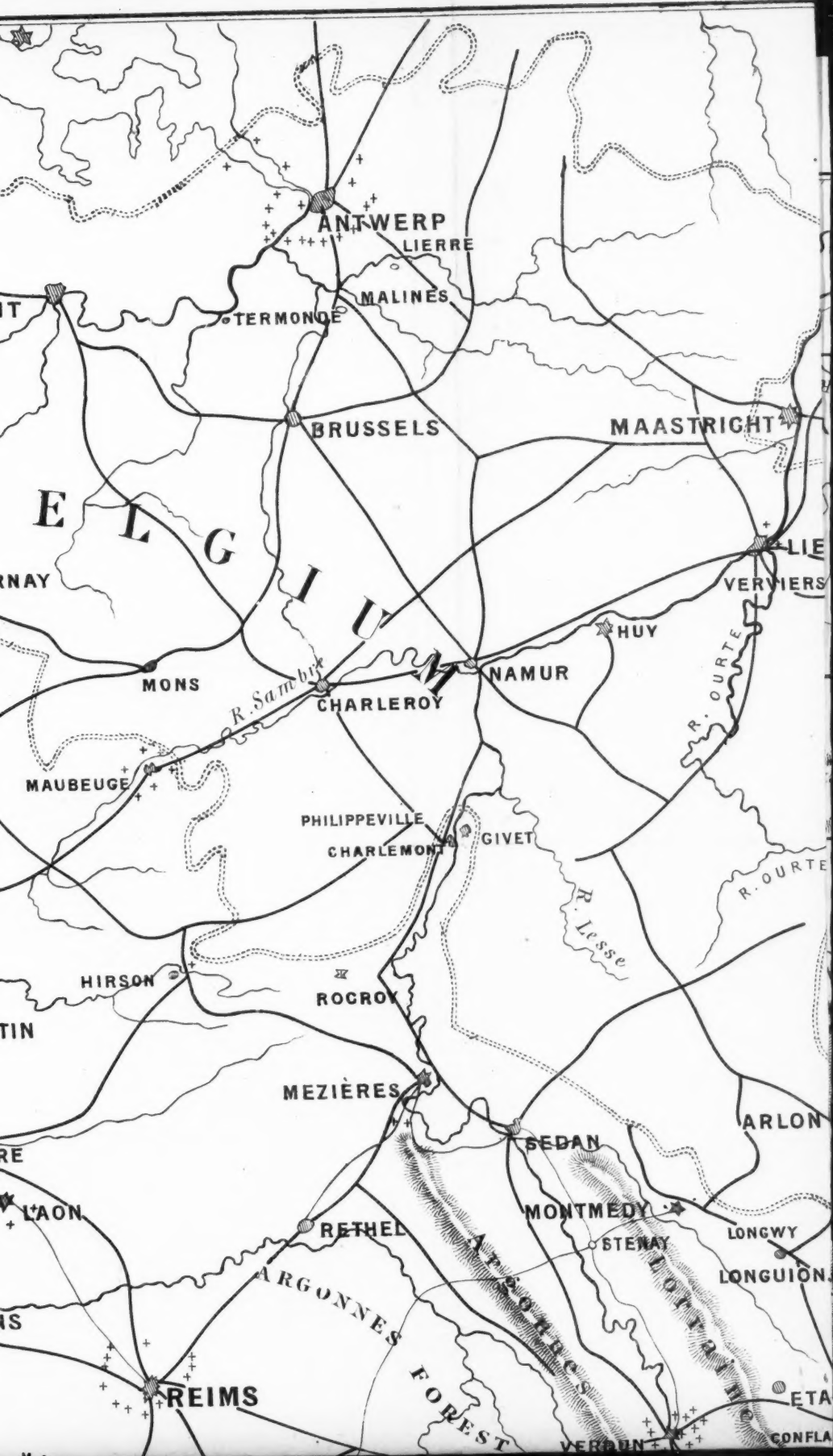
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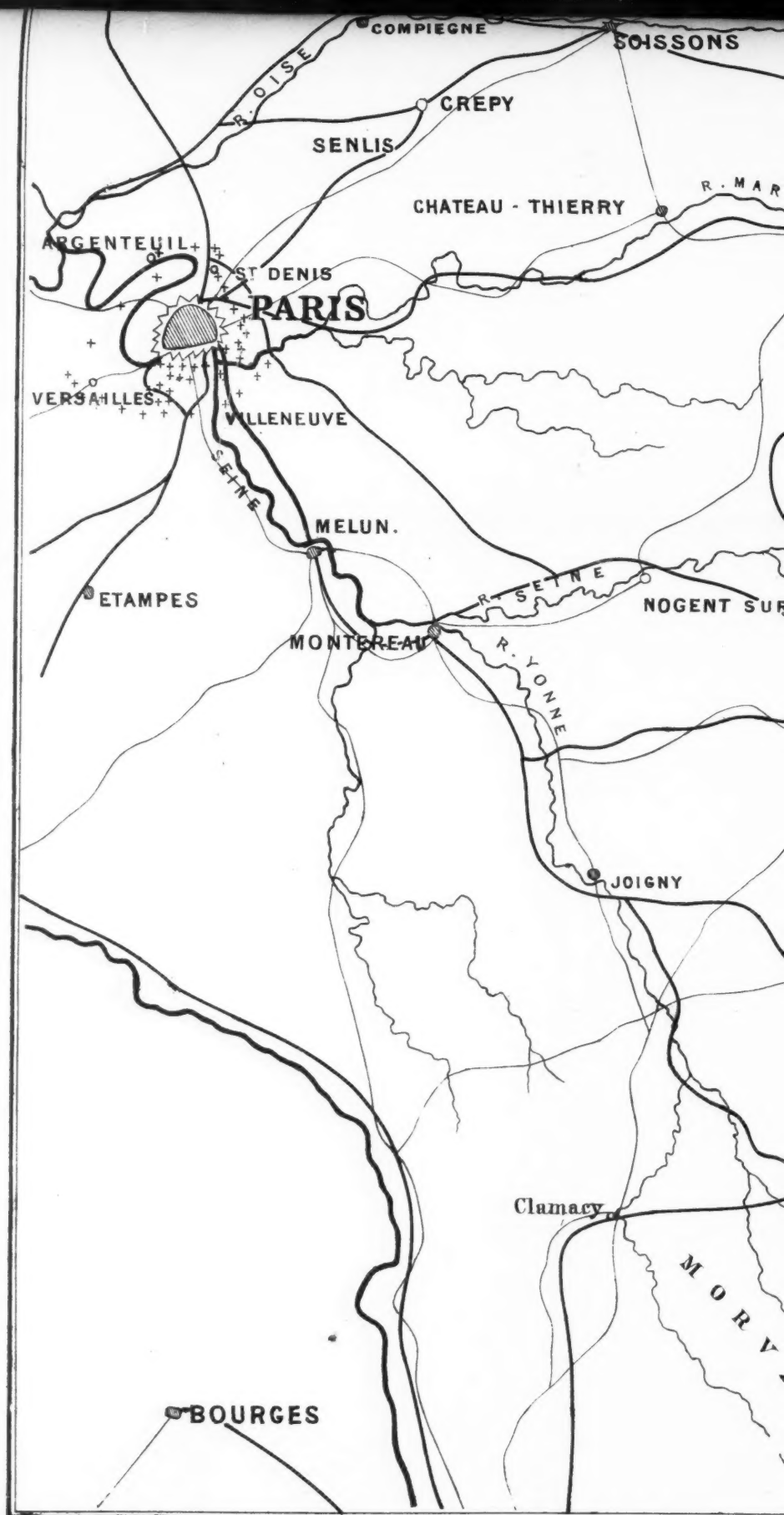
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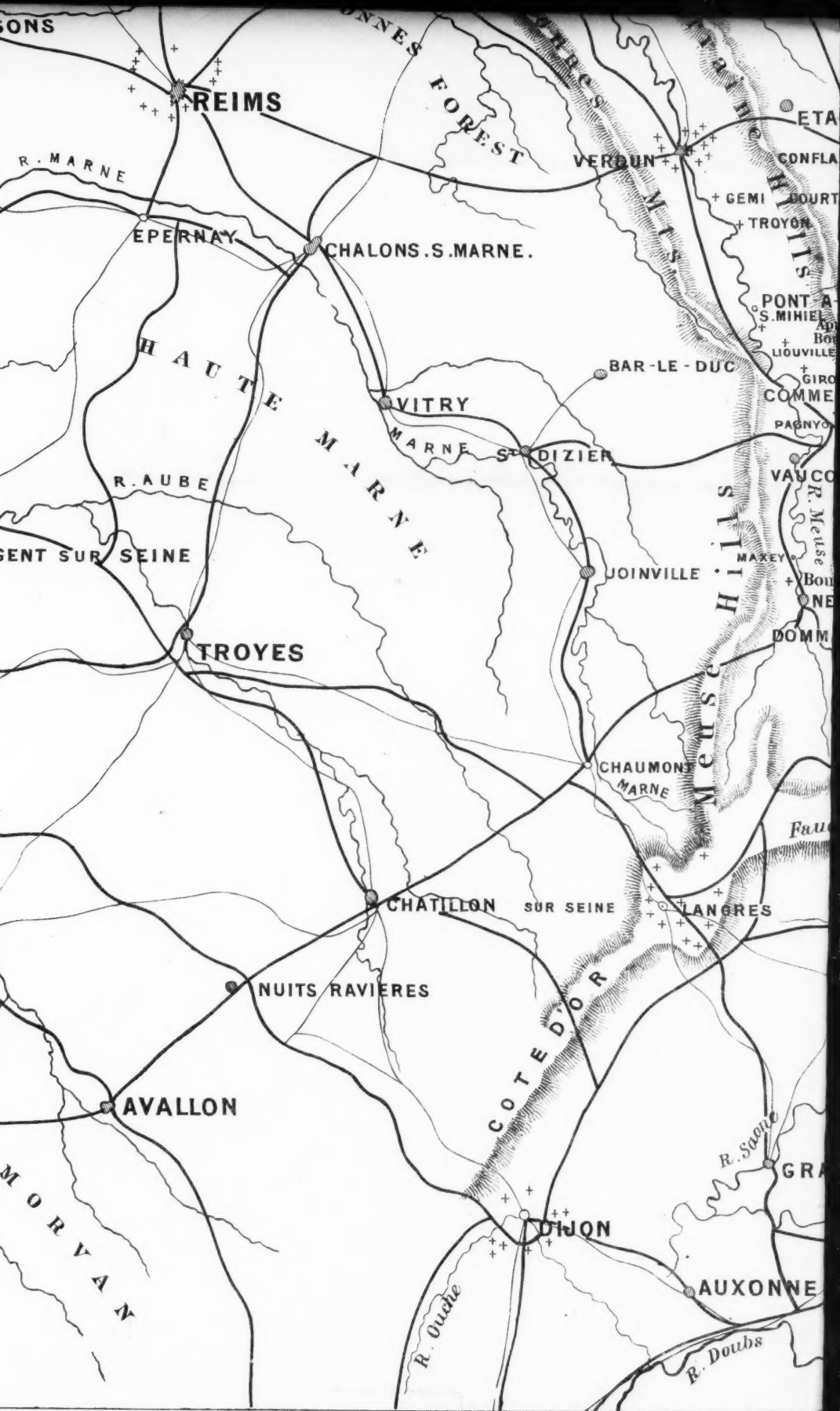
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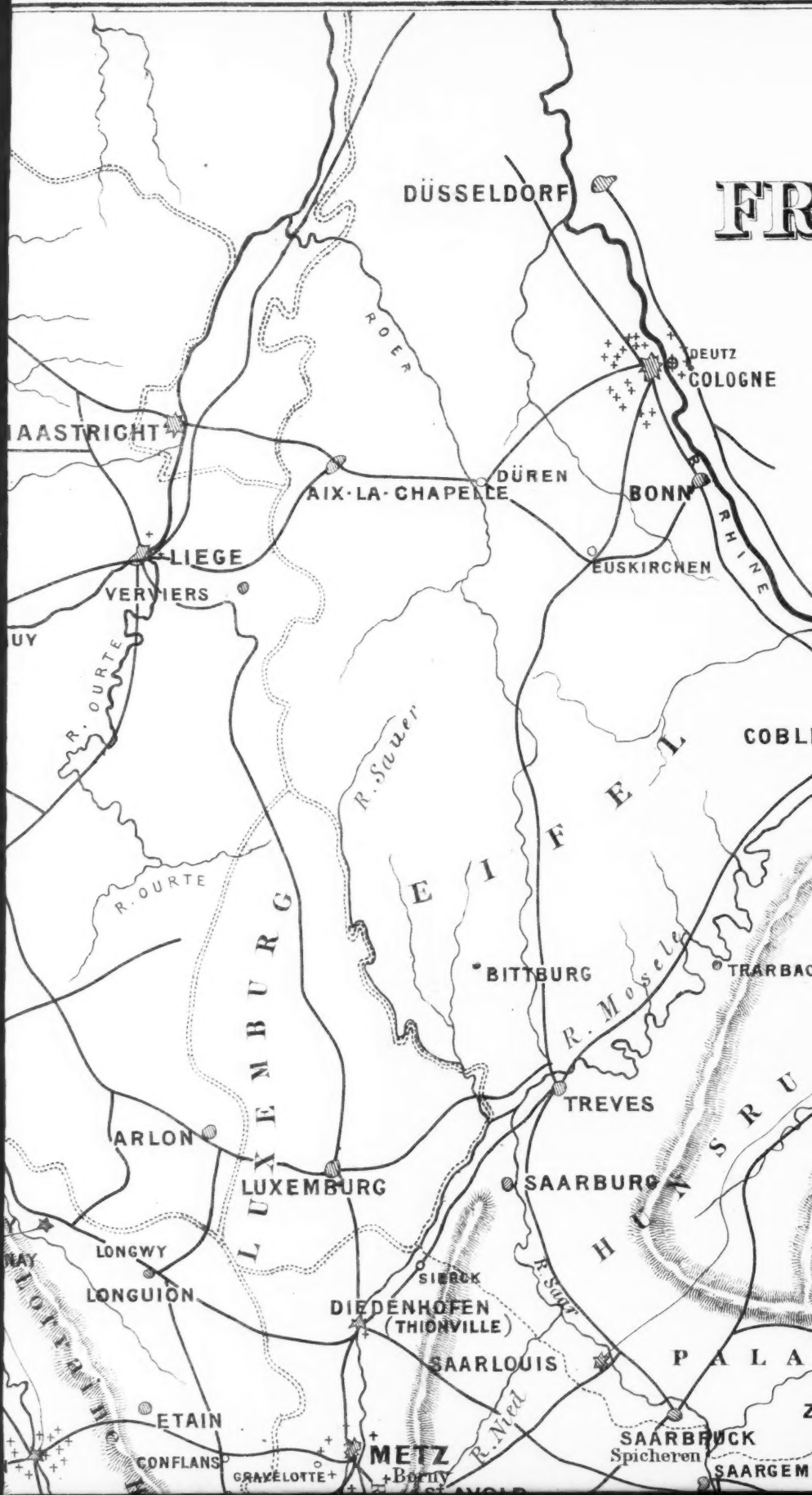
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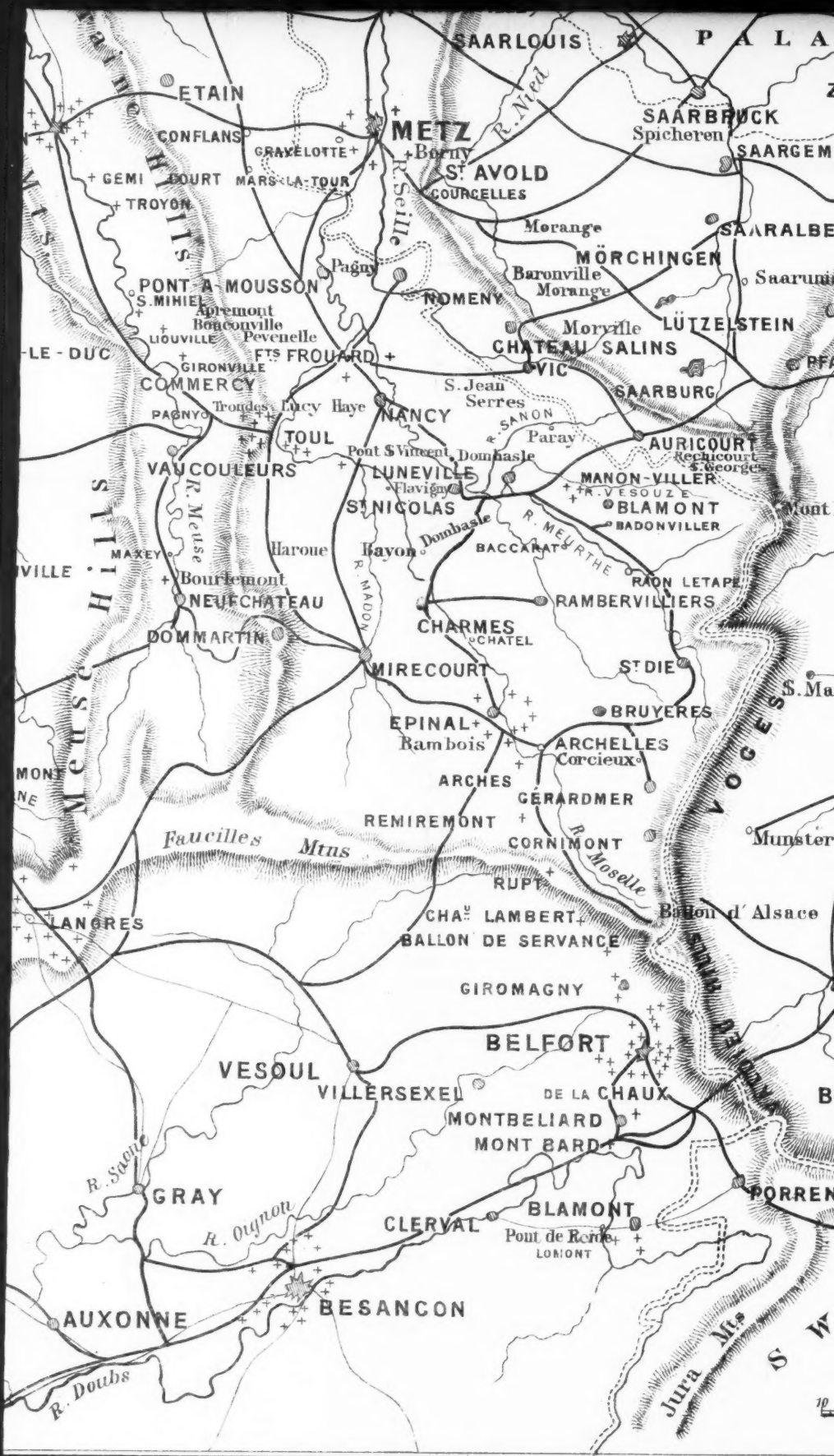


THE FRANCO-GERMAN FRONTIER.

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But there is one thing more to be said. Not all the years of German government since the last Napoleonic Empire fell have reconciled the bulk of the inhabitants of Alsace and Lorraine to what they are pleased to consider an alien rule. Treaties are very well in their way. Rivers and mountains, the rocks, and stones, and trees of villages and towns, and country, can be annexed without complaint on their part. But with the people who dwell there, with human beings having human sympathies, it is a different question. Annexation by force creates hostility even in the indifferent, and converts mere dislike into wholesome hatred. Germany may annex the whole of Europe and call it German ; but calling it so does not make it Teuton none the less. Recent elections in Alsace and Lorraine are a living protest against this absorption, not of territory, but of human life. Whatever may be thought of the annexation of Savoy and Nice, it was at any rate conducted on grounds that prevented the inhabitants from saying afterwards that they had been forced to mount the tri-colour against their will. Better for Alsace and Lorraine, better even for Germany now, if consent, not conquest, were the bond of union between them.

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RECENT CHANGES IN THE GERMAN ARMY.¹

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SINCE the publication of a sketch of the German Army, which appeared in the "Journal of the Royal United Service Institution" last year,² such very considerable changes have occurred, that it has become necessary to supplement the information there given by a short account of some of the most important alterations which have been introduced.

For a considerable time the conditions of military service in Germany have been regulated by a law passed every seven years, and remaining in force for this period, before the expiry of which a new law has to be passed. In 1886 the law in force was that of May, 1880, which came into force on the 1st April, 1881, and was to remain valid till the 31st March, 1888, but having regard to the course of European politics in 1886, the German authorities decided that it would not be safe to postpone till 1888 the increase in the Army which was contemplated, and they consequently determined to bring forward a measure which should come into operation twelve months before the completion of the seven years' period, viz., on the 1st April, 1887.

The main reason which led to the adoption of this course was a comparison of the German Army first with that of France, and secondly with that of Russia.

With regard to the former, the German military authorities recognized that after the campaign of 1870-71 France, in spite of her smaller population, had decided on maintaining a larger peace Army than Germany, amounting in 1880 to 444,477 men, or 1·18 per cent. of the French population, against 401,659, or 1 per cent. of the German population; and that in 1886 the French peace strength had risen to 471,811, or 1·22 per cent. of the population, while the legal effective in Germany was to remain at 427,274 till the expiry of the seven years' period in 1888. Moreover, it was known that a further increase of the French Army to the extent of 44,000 men was contemplated, and considering also the relative strength of the personnel of the Navy in the two countries (67,336 men in France against 13,892 in Germany), it was clear that the efforts which France was making to increase the numerical strength of her armed forces were much greater than those which Germany had hitherto considered necessary.

Russia, with her enormous resources in men, might in this point of view be regarded as a more serious menace to Germany even than France, for while France has a population of about 38,000,000, and a diminishing annual increase, the subjects of the Czar number 100,000,000, and increase quite as rapidly as do the 47,000,000 who constitute the German people.

The peace strength of the Army maintained in European Russia and the Caucasus now amounts to over 700,000 men, and the offensive power of Russia against Germany has in recent years been largely increased by the construction of various strategic lines of railway, as by means of these lines troops from distant parts of the Empire can be made available in a struggle in which, under the former conditions, they could not have taken a part.

¹ The information contained in this paper has been obtained from the "Revue Militaire de l'Étranger," the "Allgemeine Militär Zeitung," the "Deutsche Heeres Zeitung," "Löbell's Jahresberichte," and other sources.

² The German Army in 1886, vol. xxx, page 303.

Taking the peace strength, then, of the three Armies, it was seen that the German force of 427,000 men was disproportionately weak when compared with the combined strength of her possible adversaries, whose Armies amounted to 1,170,000 men, and it was claimed by German statesmen that the proposed changes were to be regarded as a necessary precaution, and in no way to be considered as a menace to their neighbours. The following table allows a comparison to be made of the peace strength of the three Armies as they stood in 1886:—

State.	Infantry Battalions.	Cavalry Squadrons.	Artillery Batteries.	Numerical Strength.
France.....	649	398	449	471,811
Russia (Europe and Caucasus)	879	502	353	700,000
Germany.....	503	465	340	427,274

Owing to the superior system of organization in Germany, the disproportion when all Armies are raised to war footing would not be so great as it here appears; but still the strength of the Army which could be sent in case of war against France or against Russia would be considerably less than the force which either of those Powers could bring into the field; it being remembered that Germany, even though at war with only one adversary, cannot leave her frontier towards the other unguarded, and cannot therefore bring the whole of her available force to bear on that side on which active operations are to be carried on.

In forming an estimate of the demands which were being made on the people of France and Germany for military and naval preparations, weight was given to the pressure of taxation, as well as to the effect of the recruiting laws; and it was seen that in 1886, while Germany for these objects spent 22,314,434*l.*, or about 9*s.* 6*d.* per head of her population, France was spending 41,330,800*l.*, or 1*l.* 1*s.* 6*d.* per head of her population.¹

Germany being thus shown to be less heavily burdened than France in the supply both of men and money for warlike purposes, it would have been unquestionably the duty of the War Minister of the Empire to propose an increase in the military establishment when, in anticipation of the expiry of the existing law on the 31st March, 1888, the new law came on for discussion in 1887; but to delay the steps necessary for increasing the Army was, as has been mentioned already, considered undesirable, and the new Army Bill was introduced into the Reichstag in December, 1886.

This measure, which of necessity entailed some additional sacrifices on the German people, met with violent opposition on the part of a certain section of the members of the Reichstag, and the Government finding themselves unable to carry it through, without modifying it so much as to change its character, recommended a dissolution, which took place on the 14th January, 1887. The result of the elections was the return of a body who voted almost unanimously for the original proposal, which thus passed into law on the 11th March, and came into force on the 1st April, 1887.

This law provides that till the 31st March, 1894, the peace strength of the German Army shall be 468,409 men, exclusive of one-year volunteers; that

¹ Excluding the cost of the Indian Army, our Naval and Military Estimates for 1886-87 amounted to 31,226,000*l.*, or nearly 18*s.* per head.

the number of infantry battalions shall be 534, of cavalry squadrons 465, of batteries of artillery 364, of fortress artillery battalions 31, of pioneer battalions 12, and of train battalions 18.

With regard to the number of men who are to form the future peace strength of the German Army, it will be noticed that this law makes an increase of 41,135 above the number voted for the period 1881-88, or sufficient raw material for the composition of two additional army corps on peace footing. The increase, however, will not be apparent in this way, the number of the German army corps remaining unchanged, but additions are made to certain arms of the Service, and these additions will now be mentioned.

Infantry Changes.—The number of new infantry battalions provided for by the law of 1887 amounts to 31, of which 30 are line, and 1 a rifle battalion. Fifteen of the line battalions are grouped into 5 new 3-battalion regiments, while the other 15 battalions are posted as 4th battalions of existing regiments, so that the total number of regiments amounts to 166. Of the 5 new regiments, 4 are Prussian, numbered 135-138, while the 5th, which is numbered 139, is a Saxon regiment. All the regiments to which an extra battalion has been assigned belong either to Prussia or to States whose forces are administered by Prussia, and are as follows:—

Corps.	State.	Nos. of Regiments.
II	Prussia	14th and 129th.
VI	"	18th.
VII	"	13th, 16th, 39th, and 53rd.
VIII	"	40th and 65th.
XI	"	80th and 83rd.
XIV	Baden	17th, 112th, 113th, and 114th.

These new formations are not composed entirely of recruits, but are for the most part formed by uniting companies detached from other regiments. Thus where a 4th battalion is added to a regiment, this battalion receives a company from each of four regiments in the Division, and where a new three-battalion regiment is raised, each regiment in the army corps contributes a company. The gaps thus caused in the old units are filled up by recalling to the colours men "at disposal," who have been allowed to go on furlough before completing their full three years' service, and also by recruits from the class of 1886 who escaped personal service by reason of drawing high numbers. These sources of supply are also available for bringing the newly created units up to their full establishment.

The 3rd battalion of infantry regiments has hitherto been known as the Fusilier Battalion,¹ but in future this distinction will disappear in the case of those regiments to which a 4th battalion has been added, and all the battalions of these regiments will alike be styled musketeers. The companies of the new battalions are numbered in the regimental series 13 to 16, and these numbers are shown on the button of the shoulder-strap in the ordinary way.

The introduction of four-battalion regiments mars considerably the uniformity which formerly characterized the regimental organization of the German infantry, and further variations are introduced by the fact that each class of regiment may be either on the normal peace establishment or on

¹ See vol. xxx, page 310.

an increased peace establishment. These establishments existed in the case of the three-battalion regiments before the recent changes, five of the Guard regiments and seven regiments of the XVth Corps having had a higher establishment than the rest of the infantry; but now there is a similar difference in the strength of four-battalion regiments, as will be seen from the following table:—

No. of Regiments on each.	Establishment.	Officers.	N.C.O.'s and Men.	Doctors and Employés.	Total all Ranks.	Horses.
130	3-battn. regt., normal	58	1,757	12	1,827	29
21	„ „ increased	70	2,072	12	2,154	29
9	4-battn. regt., normal	76	2,327	16	2,419	36
6	„ „ increased	92	2,748	16	2,856	36

A battalion on the normal establishment has 18 Officers, 570 men, 2 doctors, and 2 employés, or 592 of all ranks; and on the increased establishment 22 Officers, 676 men, 2 doctors, and 2 employés, or 702 of all ranks, with 7 horses in either case.

The normal company has now 4 Officers and 142 other ranks, and a company on the increased establishment has 5 Officers and 169 other ranks.

The four new Prussian regiments have been placed on the increased establishment, to which the four remaining regiments of the Guards and one regiment of the XVth Corps have also been raised, so that with the 12 regiments already on the higher establishment the number is now 21.

Rifles.—One new rifle battalion has been raised and assigned to the Saxon Army Corps, which has now three battalions of rifles. The only other change is the transfer of the 8th Rifle Battalion from the VIIIth to the XVth Corps, which took place on the 1st April, 1887.

The infantry, forming as it does the bulk of the Army, receives a larger share of the increase than any other arm, no less than 33,298 men of the 41,135 by whom the Army is augmented being accounted for in this way. The new formations absorb 18,778 men, the remaining 14,520 going as reinforcements to the existing units.

Cavalry Changes.—The number of squadrons to be maintained under the new law is, as it was before, 465, and no change in the establishment is made, so that the only way in which this arm has been affected is that what was known as the "Recruten-Vacanz" has been abolished. This was a period of about three weeks which formerly intervened between the departure of the men going to join the Reserve and the arrival of the new batch of recruits; but now the date of joining for the latter will follow almost immediately after the departure of the former, and the time available for training the recruits will be correspondingly increased.

In connection with the cavalry and the mounted services generally, it may be here observed that the daily ration of oats has been raised by 250 grammes ($\frac{1}{2}$ lb.) in accordance with orders of the 30th March, 1887.

Artillery Changes.—The objects aimed at in the changes recently introduced into this arm are: 1st, to increase the number of divisions of artillery; 2nd, to introduce a new distribution of batteries in the army corps; and 3rd, to increase the number of batteries having six guns horsed.¹ These objects

¹ See vol. xxx, page 319, note.

have been carried out by creating 21 new artillery division Staffs, and raising 24 new batteries, by making each Divisional artillery regiment consist of 3 divisions of 3 batteries each (instead of 2 of 4 each as formerly), and by bringing up the number of batteries on the increased, or 6-gun establishment to 41 (instead of 22 as formerly).

The normal number of batteries now with an army corps amounts to 20, grouped into 6 divisions (*Abtheilungen*), viz., 3 divisions of 3 field batteries each, forming the Divisional regiment; and 2 divisions each of 4 field batteries, with a third division of 3 horse artillery batteries, forming the Corps regiment. There are some artillery brigades in which the distribution is not exactly the same as is here given; as, for instance, the 12th Brigade, which has four batteries in each division of the Divisional regiment, bringing the total number of batteries up to 23, and the 13th, 14th, and 15th Brigades, in which all the divisions consist of 3 batteries—so that in these corps the total number of batteries is only 18.

The object of thus increasing the Divisional artillery regiment has not as yet been explained by the German authorities, and at first sight it would seem that the Divisional regiment, which is presumably to furnish artillery for two Infantry Divisions, would be more conveniently organized in two rather than three artillery divisions.

Various theories have been put forward as to the manner in which the 20 batteries of a German Army Corps will be distributed in case of a mobilization; one view being that the Divisional artillery will be the gainers, while others consider it probable that the Corps artillery will be increased.

According to the first of these theories, two of the new artillery divisions (6 batteries) will be given to each infantry Division instead of the one division of 4 batteries which was formerly allotted. In this way two divisions would be furnished by the Divisional regiment and two by the Corps regiment; the divisions of the latter each detaching a battery to form, with the Horse Artillery division, the Corps artillery, and leaving the 3rd division of the Divisional regiment available for the Reserve Division.

According to the second theory referred to, the five Field Artillery divisions will each on mobilization raise an additional battery, and thus each division of the Divisional regiment would consist of 4 batteries as heretofore, and be allotted one to each Infantry Division, and one to the Reserve Division; while the Corps artillery regiment would have 10 field batteries, of which 6, with the Horse Artillery division, would form the Corps artillery, leaving 4 batteries available for new formations.

Whichever view may eventually prove to be correct, it appears evident that there is no intention of reducing the strength of the German artillery, and that on mobilization some part of the existing force is likely to be allotted to the Reserve Divisions of the various army corps.

As mentioned in the previous paper on the German Army,¹ these Reserve Divisions used to be dependent for their artillery on the reserve batteries formed on mobilization from the Corps artillery regiments, but now a perfectly organized unit will be ready at any moment to take its place in the Reserve Division. This step would seem to indicate an intention on the part of the German General Staff to mobilize the Reserve Divisions simultaneously with the troops of the active army, and so to reduce the advantage in point of numbers which their enemies would possess at the outset of a campaign.

Of the 24 new batteries, 23 are field batteries and one is a horse artillery battery, and these batteries are raised in the same way as the new infantry formations, viz., by drawing on the regiments of the same artillery brigade. One of the new batteries is posted to each of the Divisional regiments

¹ Vol. xxx, page 341.

of 17 of the German Army Corps, and to the Hessian Division, thus making each of these regiments 9 batteries strong instead of 8. The XIIth Corps has received 2 batteries, and its Divisional regiment now consists of 12 batteries. 20 field batteries are thus allotted to Divisional regiments, and the remaining 3 are assigned to the Corps regiments of the XIIIth, XIVth, and XVth Corps, the one horse artillery battery being given to the Saxon Corps.

Eight of the 23 new batteries are to be at once placed on the increased or 6-gun establishment, and 11 other field batteries which have been on the 4-gun establishment are to be brought up to the higher standard. These 19 batteries, with the 22 already referred to, form the 41 batteries, each of which has six guns horsed in peace. These batteries belong to the following corps:—¹

Corps.	Horse Artillery Batteries.	Field Batteries.
I.....	....	6
II.....	....	6
VIII.....	3	....
XI.....	1	....
XII.....	1	....
XIII.....	....	6
XIV.....	1	5
XV.....	....	12
	6	35

The effect of the law of the 11th March, 1887, has been to increase the peace strength of the German field artillery by 142 Officers and 3,242 men; 2,595 of the latter being assigned to new formations, and 647 to the reinforcement of existing batteries.

Fortress Artillery.—This branch retains its former organization, but its peace establishment is slightly increased by the addition of some 30 men per battalion, or 927 in all. The fortress artillery has hitherto been under the "Inspector-General of Field and Fortress Artillery," but by the new law a special and totally distinct inspection-general of the fortress artillery has been created, so that the last link which united field and fortress artillery in Germany may now be said to have been severed.

Engineer Changes.—The organization of the pioneer battalions is unchanged, but each of these units receives an addition of eight or nine men. A telegraph company has, however, been raised, and attached to the Guard Pioneer Battalion, this company being designed to form the nucleus of a body of skilled telegraphists specially trained in military work.²

Railway Troops.—This branch has been increased by the staff of 3 battalions and by 9 companies, viz., 6 Prussian, 1 Saxon, 1 Würtemberg, and 1 Bavarian; so that there are now 18 railway companies formed into 5 battalions, viz., 4 battalions of 4 companies each, forming a Prussian regiment, and one Bavarian battalion of 2 companies. The increase in the number of men belonging to this branch is 1,116.

The balloon section which was formed in 1884 (see vol. xxix, page 1177) has been further developed, and now consists of 5 Officers and 50 men.

Train.—Under the former system each train battalion consisted in peace

¹ Compare note on page 319, vol. xxx.

² The peace strength of this company is 4 Officers and 138 other ranks. See also vol. xxix, page 1175.

time of two companies, the battalions belonging to the Guard Corps, the IInd Corps, and the two Bavarian Corps alone having 3 companies. The law of the 11th March, 1887, decides that all train battalions shall in future have 3 companies, and an addition of 14 companies is thus made to this portion of the German Army; the numerical increase being 1,292 men.

The distribution of the new formations which have been mentioned will be seen by the following table:—

New Formations.

Corps.	Infantry Battalions.		Artillery Batteries.		Telegraph Company.	Railway Companies.	Train Companies.
	Line.	Rifle.	Horse.	Field.			
Guard .....	..	..	..	1	1	6	..
I .....	..	..	..	1	..	..	1
II	2	..	..	1	..	..	..
III .....	..	..	..	1	..	..	1
IV .....	..	..	..	1	..	..	1
V .....	..	..	..	1	..	..	1
VI	1	..	..	1	..	..	1
VII	4	..	..	1	..	..	1
VIII	2	..	..	1	..	..	1
IX .....	..	..	..	1	..	..	1
X .....	..	..	..	1	..	..	1
XI	2	..	..	1	..	..	1
XII	3	1	1	2	..	1	1
XIII .....	..	..	..	2	..	1	1
XIV	4	..	..	2	..	..	1
XV	12	..	..	2	..	..	1
I Bav. ..	..	..	..	1	..	1	..
II Bav. ..	..	..	..	1	..	..	..
Hessian Div. ..	..	..	..	1	..	..	..
Total	30	1	1	23	1	9	14

The table given on page 308 of vol. xxx will therefore be modified as follows:—

Corps.	Divisional Troops.			Corps Artillery.		Rifle Battalions.		Cavalry Divisions.		Fortress Artillery Companies.	Pioneer and Railway Companies.	Train Companies.
	Battalions.	Squadrons.	Field Batteries.	Horse Artillery Batteries.	Field Batteries.			Regiments.	Squadrons.			
Guard	27	..	9	3	8	2	8	40	8	19	3	
I	30	..	9	3	8	1	6	30	8	4	3	
II	32	30	9	3	8	1	..	..	16	4	3	
III	24	30	9	3	8	1	..	..	8	4	3	
IV	24	20	9	3	8	1	..	..	8	4	3	
V	27	25	9	3	8	1	..	..	8	4	3	
VI	28	25	9	3	8	1	..	..	8	4	3	
VII	28	20	9	3	8	1	..	..	8	4	3	
VIII	26	20	9	3	8	1	..	..	8	4	3	
IX	24	20	9	3	8	2	..	..	4	4	3	
X	24	20	9	3	8	1	..	..	4	4	3	
XI	26	20	9	3	8	1	..	..	4	4	3	
XII	36	30	12	3	8	3	..	..	8	5	3	
XIII	24	20	9	..	9	..	..	..	4	5	3	
XIV	28	20	8	1 ¹	9	..	..	..	4	4	3	
XV	36	..	9	..	9	..	7	35	..	8	3	
I Bav. ..	27	25	9	3	8	2	..	..	8	7	3	
II Bav. ..	30	25	9	3	8	2	..	..	8	5	3	
Hessian Div.	12	10	6	1	..	..	..	..	..	..	1	
Total	513	360	170	47	147	21	21	105	124	97	55	

¹ This battery belongs to the Divisional regiment.

Staff.—Certain changes in the General Staff have been brought about by the augmentations of 1887. The number of infantry brigades was formerly 62 (see vol. xxx, p. 308), grouped into 31 Divisions. Four new brigades, 63—66, have now been constituted, and these in the usual way form the 32nd and 33rd Divisions, of which the former belongs to the XIIth, and the latter to the XVth Corps.

The XIIth Corps thus now consists of the 23rd, 24th, and 32nd Divisions, and the XVth of the 30th, 31st, and 33rd.

The Saxon Cavalry Division has been broken up, and its Staff becomes available for the 32nd Division, but for the 33rd Division a new Staff has been created, as well as for the new brigades.

Landwehr Changes.—The addition of new regiments of infantry to the German Army has as yet only led to the creation of two Landwehr battalion districts; these being in Saxony and assigned to the 139th Regiment. As the other new regiments belong to the XVth Corps, their corresponding Landwehr units cannot be formed till Alsace-Lorraine has been more thoroughly assimilated to the Empire than it is at present.

A change has also been made in the organization of the Landwehr in Berlin. The 11th Infantry Brigade, to which the two Berlin Landwehr

regiments belong, also includes four suburban Landwehr battalion districts (Potsdam, Jüterbog, Brandenburg, and Teltow), and the population of these districts has increased so largely that it is now greater than that of many brigade districts. A proposal to create an additional Landwehr inspection to carry on the increased recruiting and mobilization business in these rapidly-growing districts, was rejected by the Reichstag last year, but to meet the pressure of work this 3rd Landwehr inspection has been provisionally established.

Arms.—Great efforts have lately been made to complete the supply of the Mauser repeating rifle, and it is anticipated that sufficient for the whole of the German infantry will be ready by the 1st October, 1887. This weapon is practically identical in shooting power with the ordinary Mauser rifle, but has a magazine below the barrel capable of containing eight rounds. Its weight, with the magazine filled, and with bayonet, is 5·8 kilos. (12 lbs. 12 ozs.).¹

Clothing and Equipment.—As regards clothing no changes have taken place. The new infantry regiments which have been raised have yellow facings with yellow piping, and men belonging to the new fourth battalions are distinguished by a blue acorn on the sword-knot, as well as by the company number (13 to 16) on the button of the shoulder-strap. Infantry equipment, however, has recently received a considerable amount of attention in Germany, prizes being offered for the best designs for various articles. In the Bavarian Corps the "raupen-helm" has been abolished, and replaced by a helmet similar to the Prussian "pickelhaube," which has itself been slightly modified by the shortening of the hinder peak, and by the substitution of a leather chin-strap for the chain, when on field service or at manœuvres.

All infantry regiments, except the Guard and the twelve Prussian Grenadier Regiments, are in future to wear black belts instead of white, and other changes have been introduced with a view of making the equipment more serviceable. Among these the most important is the increase in the number of cartridges carried. The two new pattern pouches, fastened to the waist-belt in front, hold thirty rounds each; and, instead of carrying forty rounds more in pockets at the sides of the knapsack as he formerly did, the German soldier now has a third pouch for these cartridges at the back of his waist-belt. The weight of the 100 rounds which are thus carried is supported by straps passing over the shoulders beneath the shoulder-straps.

The old pattern knapsack has been condemned as being too cumbrous, and a smaller one substituted. This knapsack is somewhat wider below than above, and by this means, as well as by the removal of the forty rounds from it to the waist-belt, the man's centre of gravity has been brought nearer to its natural position. Instead of carrying a second pair of boots in the field, the German soldier is now supplied with a pair of waterproof laced shoes, and his iron ration, which formerly occupied a place in the knapsack, is now carried in a brown waterproof bag (Tornister-Beutel) fastened outside the knapsack. A new havresack (Brot-Beutel) of similar waterproof material has also been introduced; this havresack being divided internally into two compartments, and being of sufficient size to carry rations for one day as well as some extra cartridges if necessary. What is regarded as the great advantage of the new equipment is, that, with the exception of the havresack and the flask, the whole of it is strapped together, and can be put on by the soldier himself without the assistance of a comrade.

The following are the weights of the new articles of equipment :—

¹ For particulars as to this weapon *vide* "Revue Militaire de l'Étranger," No. 666. A specimen can be seen in the Museum of the Royal United Service Institution.

	Minimum.	Maximum.
Knapsack	1,000 grammes. ¹	1,300 grammes.
Iron-ration bag	180 "	260 "
Straps	350 "	450 "
Waist-belt and plate	275 "	370 "
Bayonet frog	70 "	85 "
Pouches (front) ²	620 "	770 "
Pouch (rear)	280 "	360 "
Pair shoes	1,150 "	1,250 "
Helmet	440 "	550 "
Mess tin	670 "	800 "
Havresack	250 "	350 "
Brushes, &c.	" "	600 "

A change has also been introduced in the mode of carrying the great-coat. Instead of being worn as it formerly was in a roll across the breast, it is now fastened round the four sides of the knapsack; and it is maintained that the soldier is in this way less distressed by the heat, and can more conveniently take aim when lying down.

These changes have been the result of careful trials which were made in July, 1886, the order for the adoption of the new equipment appearing on the 3rd March, 1887. It is calculated that the cost of the new equipment will amount to more than 30 millions of marks (1,500,000*l.*).

Military Education.—Among the changes recently introduced should be mentioned the establishment of a new preparatory school for non-commissioned officers, which is to be formed at Neu Breisach. There are already two of these schools in existence, viz., at Weilburg and at Annaburg; but these being insufficient, it has been decided to place the new school where it will be most accessible to the youths of Alsace-Lorraine, who have hitherto shown very little inclination to join either these institutions, or the more advanced schools, through which a large number of the German non-commissioned officers enter the Army.

It now only remains to consider how the changes introduced will affect the German people in the increased demands made upon them for men and money.

As regards the annual contingent which will now be furnished, it is only possible to give an approximate estimate based on the number of recruits who are in future to join each unit. These are as follows:—

83 infantry battalions	receiving	230 each.	19,090
430 " "	"	200 "	86,000
21 rifle battalions	"	190 "	3,990
93 cavalry regiments	"	150 "	13,950
6 horse artillery batteries	"	30 "	180
41 " " "	"	25 "	1,025
35 field " "	"	35 "	1,225
282 " " "	"	30 "	8,460
12 battalions fortress artillery...	"	200 "	2,400
19 " " "	"	160 "	3,040
19 " " pioneers	"	160 "	3,040
5 railway battalions	"	135 "	675
55 train companies	"	91 "	5,005
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			148,080

¹ 1 gramme = 0.0353 oz. avoirdupois : 1,000 grammes = 2.2046 lbs. avoirdupois.

² N.C.O.'s. pouches (for 15 cartridges each) weigh 375 to 420 grammes.

As, in the case of the cavalry and field artillery, the numbers for each unit are the minimum accepted, the total military contingent is not likely in future to fall short of 152,000 men, but this, in consequence of the growth of the population,¹ will not be more severely felt than the smaller demands made in past years. In fact, the additional young men who will now join the colours each year will be readily supplied from those who were fully qualified, but escaped personal service by reason of drawing high numbers; these having in recent years amounted to about 20,000 annually.

It is not easy at present to arrive at a just estimate of the additional charges on the German revenue which will be involved by the introduction of the changes above referred to; but it appears that the annual military votes of Prussia, Saxony, Württemberg, and Bavaria, exclusive of pensions, will be permanently increased by at least 23,000,000 of marks (1,150,000*l.*). In addition to this, a present capital expenditure of 47,560,000 marks will be necessary for new barracks, stores, magazines, and hospitals, and if to this 30,000,000 be added for the new equipment, a total of over 77 millions of marks, or 3,878,000*l.*, is arrived at.² Taking the interest on this sum at 3½ per cent., and adding it to the permanent increase, the extra cost will amount to 1,285,730*l.*, and the total expense of the German military and naval preparations will be brought up to 23,600,164*l.* This is only 10*s.* per head of her population, and is less than half what France expends for the same objects.

The above are the most important changes which have been recently introduced, and it is clear, from the thorough manner in which the steps considered necessary have been carried out, that the German Army will, under all circumstances, be kept up to the high pitch of excellence which it has attained.

¹ The population of the German Empire was 46,855,704 in the year 1885. In 1875 it was only 42,156,000.

² This may be defrayed from the military fund, in which case no additional taxation would be imposed on account of this expenditure.

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LINES OF COMMUNICATION IN MODERN WAR.¹

THE first volume of this work (which alone is at present published) deals with the lines of communications of an army in the field, and the 648 pages of which it is composed seem perhaps at first sight almost more than are required for the discussion of the subject.

But strategy, steadfast as ever to its principles, has changed many of its conditions, and is thus compelled to move by new paths to the old end. The strategy of the present day is mainly affected by two facts of recent date, namely, the existence of railways and the size of modern armies. It is not, perhaps, too much to say that the latter would have been useless, if not impossible, without the former, while together they have brought about the swift course and the decisive character of modern European war.

The object of this part of General Pierron's work is to show that the line of communication of an army has gained in importance almost exactly in proportion as it has lost in security, and that thus, while the large size of the present European armies makes them entirely dependent upon their communications, so also the safety of such a line demands the protection of such a number of troops as would in the days of the great Napoleon have been considered unnecessary and even undesirable.

This treatise on lines of communication is divided into three parts, viz. :—

- (i.) The necessity for a line of communications ;
- (ii.) The means of protecting such a line ;
- (iii.) The organization required for this protection ;

and it is proposed to follow this order in considering the subject.

I. *The Necessity for a Line of Communications.*

At first sight it would appear that a section with this heading was almost unnecessary, for probably no one who has studied war, even superficially, would presume to doubt the vital importance of such a line. We are all aware that by this line an army in the field receives its supplies of food and ammunition, its reinforcements, and its remounts, while by it are removed from the theatre of war the wounded and sick, the prisoners of war, and other encumbrances, which hamper the movements of a force in the field. In order, however, to arrive at the true meaning of the author, we should perhaps rather read "the increased necessity for a line of communications," and on this point we shall find many data of value and many useful deductions.

In the first place it is necessary to define "a line of communications." This is constantly assumed to be, and is indeed generally spoken of, as if it were identical with the line of advance of an invader, or the line of retreat of a retiring army ; but in fact it may not be, and often is not, more than partially connected with either of these. As an example may be quoted, the difference between these lines in the case of the German Army in 1870 when moving to the north before the battle of Sedan.

In order to make this matter perfectly clear, it is only necessary to define clearly these various lines ; for example :—

¹ *Stratégie et Grande Tactique d'après l'Expérience des Dernières Guerres.* Par le Général Pierron. Paris : Berger-Levrault, 1887. Pp. 648. Size 10" x 6½" x 1½". Weight under 2 lbs. 4 oz. Price 9s.

(a.) The line of communications is that by which supplies of all kinds are received.

(b.) The line of operations is that which is followed by an army in its marches and manœuvres.

(c.) The line of retreat is that which leads towards fresh strength, whether this strength be found in the mother country, or in the presence of larger bodies of troops.

If we be guided by these definitions we shall see that in the case of an invading army it will frequently happen that the line of operations will be affected by the character and the position of the defender, since the latter must be sought out and beaten in battle; it may thus be governed by tactical considerations which have no influence on the line of communications. Indeed, in principle, the latter should be as short as possible, and should not therefore follow the windings of the advance.

On the other hand, the line of retreat of an invading army will probably, should it have succeeded in forcing its way for any distance into the country invaded, be coincident with the line of communications, since on that line will be found not only the magazines but also every species of transport, while, as has been before said, it will probably be the shortest line towards strength.

The contrary is the case with regard to an army which is defending its country, for that will probably advance along its line of communications, as being the shortest road, but may undoubtedly retire on some other line, provided always that by so doing it does not abandon its communications with the great mass of the country. For example, a French army which had been defeated on the Upper Moselle might, though based on Paris, prefer to retire on Lyons, and might do so wisely; whereas Bazaine, by his retirement on Metz, allowed himself to be cut not only from his base, but from all possible bases.

There are yet other points of difference to be observed when we consider the lines of communication of an invading, as compared with those of a defending force. Thus there is no need for the latter to prepare depôts and magazines at points near to the frontier which it proposes to defend, since the lines of rail in rear will be able to supply all its needs from the central base; while, should it be compelled to retire, the system of supply will daily work with greater ease over shorter distances.

The invader on the contrary has to draw his supplies and therefore his magazines after him; he must guard a continually increasing length of line, which runs through a hostile country, and is liable to attack on both flanks from regular and irregular troops; while these difficulties increase at least in proportion to the distance of the advance. From this it follows that an invading army must be prepared, as soon as it has made good its footing in the country invaded, to bring forward for the protection of this line fresh troops, under a separate command and entirely independent of the main army.

As a general principle an invader must direct his attention to the following points, viz. :—

1. To occupy on the line of communications all defiles and all constructions such as bridges and tunnels, by permanent garrisons, who shall there entrench themselves in block-houses, *têtes-de-pont*, &c., of sufficient strength to enable the garrison to hold out until relief can come from the nearest body of troops.

2. To place the depôts, magazines, and workshops within fortified places, or if these be not available, to fortify the points where they are placed.

3. To provide a corps of navvies, mechanics, &c., for the purpose of repairing any damage which may be done by the enemy.

4. To cover the line on one or both flanks by an independent force, which shall be posted at some point whence, on receiving the alarm from their cavalry, they can be at once moved to the spot where they are needed.

The main army will sufficiently defend the head of the line, but these auxiliary forces must be prepared to protect the flanks of the communications and, where the enemy can use the railways which lead directly on those flanks, must be posted at a considerable distance from the line which they are intended to guard.

The best proof of the necessity of a line of communications to a modern army may be found in the statistics of the supply of the German forces during the war of 1870; some of these, relating only to food and ammunition, are given below.

One line of rail was, during the siege of Paris, exclusively devoted to the supply of guns and ammunition, and on the data there obtained it is estimated that 20,000 men and the same number of horses would be required to bring up a siege train over a distance of 120 miles, while it may be expected that 394 tons of projectiles and ammunition will be daily expended in the siege of a fortress of the first class.

Again, in the report which was sent in by the Commandant of Metz on the 17th of August, 1870, he estimates the expenditure of ammunition by the French Army, there collected, as likely to amount to 800,000 rounds. This may perhaps be excessive, but this Army, during the 14th, 16th, and 18th, had expended 316,000 rounds of infantry and 16,000 of artillery ammunition.

The amount of provisions expended daily by the German Army before Paris was as follows:—

148,000 loaves of 6½ lbs. each.
100 tons of rice or preserved vegetables.
595 oxen or 100 tons of bacon.
14 tons of salt.
950 tons of oats.
240 tons of hay.
6,200 gallons of brandy.

It is further stated that in a country as rich as that in which the campaign of 1870 took place, an army of 150,000 men would, with the greatest care and with a total absence of marauding, consume in 10 days all available supplies from a district of from 30 to 35 square miles.

As a standard of comparison of the relative values of railway and road transport, it may be mentioned that the daily supplies for an army of 200,000 men would require for their carriage 254 wagons, each carrying 1,300 lbs.; while on the other hand one train per diem will supply provisions for an army corps; and five trains, each of 60 trucks, will suffice for the needs of 300,000 men and 60,000 horses for 24 hours.

But with regard to the latter fact it should be added that this is possible only on condition that there be ample convenience for unloading these trains, since each of them requires ten hours to unload. In order, therefore, that the supply may be equal to the demand, there must be at least two platforms available for this purpose; yet more platforms will be needed if, in addition to the daily supply of the force, it be desired to form also a depôt of stores. If, however, the above conditions be fulfilled, an army can subsist, and move, in an absolutely unproductive country, or during the worst time of year, that which immediately precedes the harvest.

It must also be borne in mind that a train delivers the whole of the burden with which it started, since it does not, like a convoy, expend supplies during its movement, while both men and horses reach their destination by rail in better condition than they would had they marched by road.

There are, however, two great disadvantages attending the employment of lines of rail as lines of communication ; viz :—

(i.) Their use compels their protection and binds the Army, or a large portion of it, to the line of railway.

It may be added that, as the number of lines of railway increases, this disadvantage will be diminished, since a network of railways implies a quantity of parallel lines.

(ii.) Even in countries where railways are comparatively numerous, it is difficult to change the line of communication should events render it desirable to do so.

Given, however, a sufficient number of lines, this is only a matter of organization, and may, if the lines be in our possession, be prepared beforehand.

To sum up, it may be said that the huge armies of modern days will, even in the richest country, be almost entirely dependent on the lines of rail for supplies of all kinds ; that these will therefore always form the lines of communication ; and that they, difficult as they are to protect, must be guarded throughout their length in a hostile country ; moreover that this duty of protection should be, and probably always will be, carried out by auxiliary forces distinct from the main Army, and under a separate command.

The system to be employed to give the necessary protection will include the occupation with small garrisons of fortified posts at vulnerable portions of the line, in combination with flying columns moving from strategical points, and supplied with an ample force of cavalry, who shall scour the country and give early notice of any movement of the enemy.

II. *The Protection of the Line of Communication.*

The protection of a line of communication may be divided into three parts ; viz :—

(i.) The provision of detached corps or armies, who shall prevent the armies of the enemy from striking the flank of the rear of the invader.

(ii.) A permanent appropriation of troops, who shall be employed in reducing such fortresses as may cover the line of railway, in keeping order among the population and in repressing the action of any irregular forces of the enemy.

(iii.) The defensive occupation by detachments of the various strategical points on the lines of rail, as also of all tunnels, bridges, defiles, &c., and a sufficient supply of garrisons for the halting-places on the line.

Of these the first will as a rule form part of the duty of the main field army, and nothing more will therefore be said of it, since its execution forms a part rather of the general strategy of campaign than of the protection, strictly speaking, of the line of communication.

The second and third duties will usually be discharged by "Landwehr" or corresponding auxiliary forces, and of these it is proposed to speak at some length.

It may be assumed that the strength of these "Line troops" will rarely be sufficient to allow them to oppose with success any one of the armies of the enemy, but they will, even though extended over a large expanse of country, be as a rule in a position to repress the action of partizans or guerillas, and to keep the population in subjection.

For the discharge of these two duties the troops will be divided into—

(a.) Flying columns.

(b.) Stationary detachments.

Of these the former will be placed on the flanks of the line of railway, while the latter will occupy a series of posts along its length.

The space at our disposal will not allow of a full consideration of the means taken by the Germans in 1870 to cover and protect their lines of communication, a subject which is detailed at great length by General Pierron; but the following short sketch of their proceedings will give a general idea of the difficulties surmounted, and of the forces needed to secure their communications with the fatherland. It is worthy of remark that so anxious were they to use railways wherever possible, that no pains were spared to reduce the fortresses which guarded the lines, while extraordinary efforts were made to repair any bridges, &c., which the French had destroyed.

At the commencement of the war thirty battalions, thirteen squadrons and a battery were allotted as a guard for the communications, while a company of engineers was told off to the Inspector-General of the line of each army, in addition to some detachments of special mechanics.

The Governors-General of Alsace and Lorraine were, after the first successes, placed in charge of the line of communications, and under their care the restoration of the railway from Sarrebruck to Courcelles-sur-Nied was completed before the commencement of the investment of Metz. By the 23rd of September, a junction line, which turned Metz, was made from Remilly to Pont-à-Mousson.

The line from Wissembourg to Nancy was on the 23rd of August open as far as Toul, but in spite of repeated efforts, that place was not captured until the 23rd of September.

In the meantime, owing to the advance of the German armies, it had been found that the proposed system was not of sufficient strength to ensure the due protection of the long lines of communication, and on the 8th of September the XIIIth Corps, which had been left in Prussia to cover the country from a possible invasion by the French by sea, was ordered to move into France and to occupy the country between Metz and Paris. At the same time the battalions on the line were raised from 4 to 6 companies, giving a strength to each of about 1,200 men. Some troops were also detached from the IInd and IIIRD Armies to assist in this duty.

The arrangement then made was as follows:—The lines between Metz and Germany were left in the hands of the staff of the 1st and IInd Armies; the XIIIth Corps was to secure the communications between the Moselle and the Belgian frontier, as also the line Mézières—Rethel—Reims—Epernay—Vitry, and especially to guard the railway from Nancy to Châlons-sur-Marne. On the west of the latter line the task was taken up by the IIIRD Army and by the army of the Meuse.

Even before the fall of Toul the railway between it and Paris had been completed as far as Nanteuil, which was thus by the 28th of September connected directly with Wissembourg. But between Nanteuil and Paris traffic was for a long time interrupted, owing to the destruction by the French of two tunnels and three bridges.

Little more could be done until the surrender of Metz should set free the besieging forces, which might then widen, towards the north and south, the very narrow strip through which the German communications ran.

But all preparations were made beforehand to take immediate advantage of this event, whenever it should come about, and to this end efforts were made to occupy the line Châlons—Reims—Soissons—Paris (which has a station at Mitry), as also that of Châlons—Reims—Laon—La Fère—Paris, which has a station at Gonesse.

But in addition it was desired to possess a second line of communication with Germany, and with this object it was proposed to seize the railway Reims—Mézières—Thionville—Metz—Sarrebruck. The possession of such a second line was considered well worth the sieges of the five fortresses which defended it.

Towards the south the task was yet harder, and in that direction the Germans contented themselves with repairing the line Blesme—Chaumont—Châtillon-sur-Seine—Troyes—Montereau—Paris, with an auxiliary line Châtillon-sur-Seine—Nuits-sous-Ravières—Joigny—Montereau; this work was carried out by the IInd Army after it had been set free by the fall of Metz.

Towards the end of September preparations were made to open the branch lines Châlons—Reims and Rethel—Reims—Soissons—Mitry. Soissons was besieged and Mézières blockaded.

On the 15th of October the former fell, and became available, in place of Château-Thierry, for the supply of the army of the Meuse. On the 21st of November the section Soissons—Mitry was opened, having been up to that time closed by the destruction of the tunnel at Vierzy; on the same day the railway from Nanteuil was extended to Lagny-sur-Marne.

After the capitulation of Metz the various sieges and blockades were taken over by the Field Army from the Landwehr, and the duties of the latter were confined to the care of the line of communications. The troops applied to this use amounted on the 31st of October, 1870, to 85 battalions, 33 squadrons, and 57 guns.

The 1st and IInd Armies were ordered, while moving from Metz on Paris, to advance on as wide a front as possible, and to disarm all the inhabitants on their way. At this time also the rapidly increasing size of the theatre of operations necessitated the calling of yet more troops of the Landwehr from Germany, in order to set free more of the army for service in the field.

The repair of the branch line from Blesme to Chaumont was commenced on the 6th November. The line from Montereau to Troyes was, however, abandoned on account of the impossibility of repairing the bridge at the former place, and it was determined to employ all available hands in the repair of the line Chaumont—Châtillon-sur-Seine—Nuits-sous-Ravières—Joigny—Sens—Moret—Montargis—Juvisy—Orléans, which was, as regarded the latter part of it, of great importance, as by it the IIIrd Army before Paris, and the IInd Army at Orléans were able to render mutual support. This line was not, however, completed until January, 1871. But the section Blesme—Chaumont—Châtillon-sur-Seine was ready on the 2nd of December, Chaumont—Troyes on the 7th, and the branch from Châtillon-sur-Seine to Nuits-sous-Ravières on the 25th.

In the north the lines Compiègne—Clermont—Beauvais—Creil—Chantilly and the branch Crépy—Gonesse were in full use before the arrival of the 1st Army from Metz, while on the 21st of November the line Reims—Soissons—Mitry was opened. By the end of December the entire line Reims—Laon—La Fère—Creil—Gonesse was open, having been delayed till then by the destruction of the bridge at Chantilly.

The 1st Army, as it advanced, repaired the line from Clermont and Tergnier to Amiens and then from Amiens to Rouen; while towards the east the lines from Reims to Clermont-en-Argonne, and from Rethel to Boulzicourt-devant Mézières, were rendered fit for use.

The whole of this system of railways to the north was appropriated to the 1st Army, and the Army of the Meuse; the IIIrd Army used the grand artery from Nancy to Nanteuil, and after the 23rd of November to Lagny and Chelles; while the IInd Army, as it moved towards the Loire, communicated with Germany at first by the line Blesme—Nancy—Wissembourg, and later by the branches to the south of the first of these.

But there was one grand defect in this system, namely, that the four armies, two before Paris, one on the Somme, and one on the Loire, had to pass all their supplies over a single section, that between Frouard and Blesme, while three of them had to use also the section between Blesme and Châlons.

So long as all went well, this section could pass sixteen trains per diem (of which three were devoted to the 1st Army, four to the IInd, six to the IIIrd, and three to the Army of the Meuse), but the smallest difficulty or accident caused a deficiency of even necessities.

The surrender of Mézières at last rendered it possible to make use of a second line of communications, but although, in anticipation of this event, the sections Reims—Bonizicourt and Metz—Mézières had been repaired, so much time was required to make good the parts about Mézières and Montmedy, that the line was not in full working order until the 21st of January, 1871. From that date the 1st Army and the Army of the Meuse drew their supplies by this line.

Efforts were made with some success to open lines to the west of Paris, but the scarcity of rolling stock prevented them from being of much use; on the other hand by the middle of January the line Juvisy—Orléans had been extended to Blois.

We may conclude this statement by giving the strength of the guard of the line of communications at the following dates:—

1st January, 1871. 124 battalions, 42 squadrons, 13 batteries, 39 companies of fortress artillery, and 15 companies of engineers.

1st March, 1871. 114,090 infantry, 5,686 cavalry, and 68 guns. At this latter date the total strength of the German Field Army in France was 455,782 infantry, 57,779 cavalry, and 1,674 guns. There were thus more than 23 per cent. of the total number employed on the line of communications.

The Duties of the "Line Troops."

(i.) *Treatment of the Inhabitants.*—The first duty of the troops who are in occupation of a hostile country is to provide for the disarmament of the population. This should be carried out systematically, the delivery of all arms being demanded by proclamation under penalty of death. The arms should be received in some large building, or courtyard, and should be at once rendered unserviceable by workmen procured for that purpose. All stores of gunpowder and other explosives should be demanded at the same time and destroyed.

In order to prevent the communication of intelligence by the inhabitants, orders should be issued forbidding the ringing of church or other bells; care should also be taken that no one has access to belfries or steeples.

Every street must be lighted at night, but, with the exception of priests and medical men, no one of the inhabitants should be allowed to leave his house after dark unless provided with a special permit. At the commencement of an attack, or on any alarm, the whole of the population must retire at once to their homes.

No inhabitant of the country should be allowed to travel by road, railway, or water, unless in possession of a permit.

Should any difficulty be experienced in managing the population, hostages will be taken from among the principal inhabitants; these may be either detained at headquarters, or may, if it be considered desirable, be sent to a distance from their homes.

Should it be reported or discovered that torpedoes of any description (or any other source of danger) have been laid down on a line of railway, some of the principal inhabitants, by roster, should be compelled to travel with each train, either on the engine or in a carriage in front of it.

Any co-operation with partizans or irregular bands, or any efforts to destroy railways or telegraphs should be rigorously punished; a severe example at first results in the end in saving of life.

It has been found in practice that the frequent infliction of the penalty of

death, while it excites the hatred of the population, tends to defeat its own object; severe fines rigorously collected and the careful disarmament of the inhabitants will generally produce better results. But no levy of money, or any requisition, should be permitted except by order of the highest authority, from whom also all punishment should proceed. Marauding and oppression of all kinds must be repressed with a strong hand.

Under certain circumstances the inhabitants of a locality may be called upon to put down brigandage; in any case they should be made answerable for all outrages. The French in Spain compiled a register of the inhabitants of the districts by households, and compelled the head of each to be responsible for those in his house.

Instances will often occur in dealings with savage or semi-civilized nations where, by paying attention to their national customs or religion, forces of far greater power than the fear of death can be brought to bear in favour of the preservation of quiet. For example, a rising against the Dutch in Java was suppressed, after all other means had failed, by a threat to destroy the tombs of the ancestors of the principal leader.

Kindness and consideration will seldom fail to produce a good effect; thus the Russians in 1829 secured peace on their lines of communication by promising the Turks to respect their social and religious customs, and by leaving the administration of the occupied provinces in the hands of the native authorities, subject only to the Russian military powers.

Every effort must be made to pay for all supplies with ready money, and if a little more than the market price be paid the full value will be obtained in popularity.

(ii.) *The Care of Bridges, Viaducts, and Tunnels.*—Bridges should be closed by barricades, and should be defended by a fortified post; access should be forbidden to them at night by means of a wire entanglement. Viaducts and long bridges should be provided with a post at each end; these may be prepared either by strengthening an existing house or by constructing a block-house with sleepers and rails. They must be of sufficient size to hold an adequate garrison, and of such strength that they will be able to hold out until relieved.

Patrols are to be used by day and double sentries by night.

A system of signalling by semaphores and lights must be arranged, in order to retain the power of communicating with the adjacent posts should the line of telegraph be destroyed by the enemy.

Notices should be sent to the inhabitants in the vicinity directing them, under penalties, to give warning of any proposed attempt upon the post which may come to their knowledge. They must be also warned that, should they not be aware of such an attack until the moment of its execution, it is then their duty to at once send notice to all adjoining posts of the action of the enemy.

Tunnels will be guarded on a similar system, and are to be closed at night unless trains run after dark. A supply of sandbags should be collected at each end of a tunnel, in order that with them a parapet may be at any time quickly thrown up. As the mouths of tunnels are always commanded by the neighbouring country, some sort of overhead cover is a necessity for any post which is stationed at one of them.

The posts at the end of a tunnel must be connected by telegraph or by a bell, and should also be provided with lanterns for the purpose of searching the tunnel.

Stations should be furnished with a "reduit," which should be palisaded; small stations should be entirely surrounded with a stockade.

(iii.) *Posts on the Line of Communications.*—The garrison of posts on the line of communications must construct a "reduit" for their post; this should

be placed at one end of the village or town, in order that relief may, in case of emergency, be easily effected by troops from other places. This "reduit" must be well supplied with food, water, and ammunition, and must be carefully fortified.

The garrison will always sleep in this fortified post; troops passing through will be billeted in another part of the place, or may occupy another defensible post.

All inflammatory materials must be kept carefully under a guard, and arrangements must be made for the provision of a fire-engine and a supply of water.

Patrols must be freely employed by day and sentries by night, especially at the issues of the place. The inhabitants must be called upon to give warning of any proposed attack.

(iv.) *Convoys*.—These may be divided under two heads :—

(a.) Convoys of prisoners.

(b.) Ordinary convoys.

(a.) No communication whatever must be permitted between the prisoners and the inhabitants of the country; the latter will probably wish to feed their countrymen; this must not be allowed.

The Officers who are prisoners will not be allowed to march with their men; nor will any prisoner be permitted to leave the ranks while in a village or a wood, or to speak to any person at any time.

Convoys of prisoners will make a double march daily.

A portion of the escort will march at the head and another at the rear of the column: the remainder will extend along the flanks. The order of march should be as compact as possible.

Halts will be made in open spaces only, and the nights will, when possible, be passed in large isolated buildings, which must be well lighted, and around which sentries and patrols must be posted.

Provisions and the means of cooking them must be carried, in case of a failure to find supplies at the halting-place; and any mounted men who may be present with the column must be employed while on the march in collecting supplies.

(b.) Ordinary convoys.

The escort will march as in the former case. The commander of the convoy must be mounted.

If any cavalry be present they will scout to a considerable distance; on the approach of an enemy, the convoy will endeavour to gain a village or some defensible place.

If no mounted men be available for the purpose of scouting, the convoy must be preceded by some of the inhabitants of the country, whose families will be held responsible for their fidelity.

(v.) *Requisitions*.—Requisitions should not be made on the line of communications; the supplies on that line should be reserved for the use of passing troops.

Troops sent on this duty will not carry packs. They will start by the safest route, and return by that best suited to carts, &c.

A force sent to make a requisition should before daybreak place a chain of posts round the village to be requisitioned, in order to prevent the inhabitants from driving away their cattle or horses or from giving notice to the enemy. Patrols should be pushed out in all directions while the requisition is taking place.

The requisition will be made by the local authorities, and some of the principal inhabitants should be held as hostages during its continuance. All stables, cattle-sheds, barns, &c., should be carefully inspected in order to make sure that nothing is concealed. When a village lies near a river, the

inhabitants will hide their cattle on the islands, in other places in the woods.

If payment is to be made for the goods, no money should pass until the latter have been stored in the magazines.

If no local authority be available, the houses, &c., will be searched, and the supplies will be loaded on to carts, which as they are filled will be parked under an escort at some point outside the village. Every effort must, however, be made to avoid the use of troops in this search, as to do so may lead to theft and drunkenness, and must in any case tend to break up the column.

If there be any difficulty in finding out the amount of supplies which may be drawn from a place, the best plan is to empty the barns, &c., of the largest farmer, who will then, in order to avoid being left destitute himself, certainly give information as to the possessions of his neighbours.

All cattle and horses should be marked as soon as requisitioned; otherwise exchanges will be made.

When leaving the village hostages should be taken, as otherwise the inhabitants may fire on the rear guard. These hostages may be employed in driving the cattle, &c.

When requisitions on a large scale are necessary, the force making them will on the first day march to the farthest limit of the zone which is to supply them, and will there occupy all roads, in order both to prevent the removal of the goods and also to gain timely notice of any advance of the enemy. During the following days it will gradually close in towards the cantonment. The convoys which contain the supplies which have been requisitioned will be escorted by cavalry, while infantry will cover the movement.

(vi.) *Flying Columns*.—Flying columns are far more effectual than small isolated posts for the repression of disorder.

No information should be given by the commander as to the route which he intends to follow; he should merely indicate the probable number of days of absence.

No wheeled transport should be taken; such ammunition, medical stores, and provisions as are needed must be carried on pack animals. It may, however, be sometimes necessary to take a few light guns, in order to have the power of forcing defiles or of attacking small posts and villages.

If it be desired to conceal from the inhabitants the number of troops in the column, the force may be made up of detachments wearing different uniforms.

When the column leaves any place towards evening, it should start by another road than that which it proposes eventually to follow, and should make its way to the latter by a circuitous route.

The column should bivouac under cover (e.g., in the middle of woods) and should not take up its final position for the night until darkness has set in; it should march again before daybreak. If guides be used, they should not be allowed to leave it until they are at a considerable distance from their homes.

If it be desired to surprise any place, it should be approached from a direction contrary to that from which the force may be expected.

By day the column should conceal its march by moving in low ground or through woods; or it may remain halted out of sight in ambush.

The column should endeavour to seize all messengers, and to occupy all telegraph stations; also to possess itself of all correspondence at the post offices, and of newspapers and official documents of every kind.

Forces charged with the repression of brigandage must not wait to be attacked, but must take active measures to find and destroy the bands; too great haste will, however, often lead to disconnected movement, and all forays should be worked out on a coherent plan.

No terms whatever should be made with irregular troops or guerillas until they have been defeated; any favours offered to an unbeaten force are sure to be regarded as a proof of weakness.

When pursuing a band of guerillas the column should, before attacking them, seize on their line of retreat. If the band be reported to be in a certain village, the force should not march immediately on the place, but should first occupy the roads leading from it, especially the enemy's line of retreat.

Troops which take up an ambuscade should not leave the road at the spot selected, but should march beyond it, and then turn back to it, in order that their footprints may not tell a tale.

Woods are easily searched by an enemy; ambuscades should therefore be placed in low ground, hollow roads or quarries. By night cover which lies near the road forms the best post for an ambuscade.

When it is proposed to remain for any time in occupation of a district, or if a main road runs through it, the woods and all cover should be cleared at the sides of the road for a space of at least 200 yards. This work may be carried out by civil labour, for which the sale of the wood will pay the wages.

(vii.) *Defensive Works on a Line of Communication.*—With regard to these it will be sufficient to state the principal rules given by General Pierron without entering, as he does, into technical details:—

"The defensive works which are erected on a line of communications should be proportioned as to their character to the nature of the arms which they may be called upon to resist.

"If only partizan corps unprovided with artillery are to be expected, loopholed buildings, made safe from fire, covered by abattis or by wire entanglements, and having an open field of fire in their front, are all that are needed.

"Against field artillery, redoubts and deep shelter-trenches will be sufficient.

"But if siege artillery may be used in the attack, it is better to sink a trench than to raise a parapet of high relief. Deep trenches shelter troops from both curved and direct fire."¹

As may, perhaps, be gathered from the above, the varieties of works laid down in this volume are almost too complicated and permanent in their character for use on a line of communication, including as they do plans and profiles of the Turkish forts at Plevna, of the German fortifications around Paris, and of field redoubts which might, if time allowed, be thrown up for the defence of a line of battle.

Some notes are, however, given as to laagers and as to the defences of posts in Ashantee, as also of a New Zealand pah; these, being derived from English sources, are, though interesting, not new to us.

III. *The Organization of a Line of Communications.*

The supreme power over the entire system of railways, and over the whole of the line of communications, should be placed in a single hand. This Officer may be styled the General of the Line of Communications, or the Inspector- or Director-General of Communications and Railways.

This Officer will himself be placed under the orders of the Chief of the Staff of the Commander-in-Chief of the army or armies.

In order to diminish as much as possible the length of the line of communications (in the strict sense of the word), those of our own provinces which lie nearest to the theatre of war, and also such of those of the enemy as we

¹ But deep trenches also hamper the troops which defend them, rendering it difficult for them to deliver their fire.—N. L. W.

have fully occupied, should be constituted under Governors, and should receive a settled form of civil government, having their own garrisons, and their own civil service. These governments will be independent in all respects of the military authorities.

The General of the Line of Communications will have entire command of the lines of railway between such provinces and the army, and will in addition have power to decide as to the sequence in which the various supplies shall be sent to the front, or the impedimenta shall be withdrawn from the army.

Under this Officer the following shall form distinct sections of this service; viz. :—

- (i.) Railways.
- (ii.) Posts on the line and convoys.
- (iii.) Ammunition.
- (iv.) Provisions and supplies.
- (v.) Medical and sanitary service.
- (vi.) Police.
- (vii.) Civil administration.

It will be convenient if we follow this order in considering the organization of each of these branches; it is not, however, proposed to enter upon the question of the numerical strength of the Staff of each, as that must vary with the conditions of any particular war, and would further require more space than is at our disposal.

(i.) *Railways*.—As a fundamental rule, the time which is needed to empty a train must be the measure of the rapidity of succession which is permissible.

On each line of railway which is used by the army a "*Base Station*" must be selected; at this point the men and material to be forwarded to the front must be collected, and here also all that is returned from the army will be received. A large junction should be chosen for this purpose, and should be provided with extensive platforms, abundance of sheds, and every convenience for sheds, and every convenience for loading and unloading, such as steam cranes, ramps,¹ &c. Care must be taken that these, and all stations, are well lighted by night.

Ample space and every facility should also be at hand for the billeting and the cantonment of troops.

In order to avoid overworking this station, troops who are not encumbered with baggage or stores should be entrained at the neighbouring smaller stations.

If an army is dependent upon a single railway with but one line of rails, this should be reserved for the carriage of material and individuals; all bodies of troops and all animals should be moved by march route.

A "*Transit Station*" should be established on each line, at the point where the civil direction of the railway is merged into the military; this station will serve to mark the boundary between the two authorities.

A "*Magazine Station*" must be established at each end of any section of railway which is common to several lines of rail. This will mark the limit to which private individuals and contractors can despatch their goods. The selections of the supplies to be forwarded will also be made here, and it will further serve as a depôt in which the supplies to be despatched to the army can be regulated as to their amount and order of succession.

It is very desirable that this "*Magazine Station*" should stand near a river or canal, which may assist in the carriage of goods; when this is the case the station and the river should be connected by a line of rails.

¹ Ramps should be made at right angles to, as well as in prolongation of, the platforms.

At this "Magazine Station" should be posted representatives of the various departments of the army (artillery, engineers, commissariat, medical, postal, telegraphs, and pay departments), in order that each may receive the stores belonging to it, and may decide as to what is to be sent on to the army.

As a rule trains *from* the army will make but a short halt at a magazine station.

A "Terminus" must be designated at the end of each line of rail; this must be within the theatre of operations, but beyond the immediate reach of the enemy. At this point all supplies destined for the army will be unloaded, and all that is returned from the army will be entrained.

In order to avoid overcrowding, the neighbouring stations will also be used for these purposes.

Before the "Terminus" is taken into use, it must be fitted with sidings, platforms, and sheds, and must also be provided with cranes and other appliances for unloading.

At this point the railway transport will cease, and in order to continue the despatch of stores, &c., to the army, it will be necessary to establish at each Terminus parks of wagons, of which each will contain the load carried by a train of forty trucks.¹ As five four-wheeled wagons will carry the contents of a 5-ton truck, each park must consist of 200 wagons.

Porters, packers, and wheelwrights, under military discipline, will be quartered at the terminus; roadmakers will be needed to keep the roads from it to the army in repair; and carpenters to erect sheds and barracks.

Magazines of spare stores and supplies must be established at the terminus, and portable bridges, road-engines, travelling cranes, and traction-engines should be collected there.

At all intermediate stations the number of sidings must be increased, in order to accommodate the following trains, which must always be held in readiness:

(a) "Emergency trains," which are complete trains loaded with supplies for a definite unit; these trains are intended for the general service of the army, and not for any one fraction or arm.

(b) "Breakdown trains," carrying all that is necessary for the repair or reconstruction of the permanent way; spans for bridges or viaducts, rails, crossings, points, tanks, coal-wagons, and spare stores for locomotives and for rolling-stock.

The number and length of the sidings at all stations between the "Magazine" stations must be increased, to allow of the parking of trains. It is very desirable that special lines should be made by the side of the permanent way for the use of the light trains carrying troops between these stations.

The "Base Station," the "Magazine" and the "Terminus" stations must all be provided with ample means for loading and unloading, such as manual labour, fixed cranes, elevators, travelling cranes worked by steam, winches, tackles, blocks, trucks, and small carts. They must also be supplied with a sufficient number of porters, packers, and carpenters, with their tools and materials.

Platforms and sheds must be constructed, and the roads leading to them macadamized or paved. An ample supply of waterproof coverings, awnings and tents, will also be needed, in order to secure the safe storage of goods for which there may be no room in the sheds.

Each consignment of material must be accompanied, from its starting-point to its destination, by an agent who shall have a way-bill. Every despatch of goods, whether towards or from the army, must be notified *beforehand* by

¹ The description of the contents of every truck should be marked on it *in paint* at the "Base Station;" chalk soon rubs off.

telegraph, and no train must be allowed to depart until information has been obtained that the sidings or sheds are in a condition to receive it and its load; or, in the case of troops, that there is accommodation for them.

When the railway consists of but a single line, the precedence, when two trains have to pass each other, should be given to that which is *returning* from the "Terminus," for the rapidity of supply is governed by the rate of unloading, and by the pace at which the end of the line can be freed from accumulations.

At the "Magazine" and "Terminus" stations a representative of each corps and of each department should be stationed, in order that he may discover the goods which are destined for it, and may look after their due despatch.

Each station must be provided with a military commandant, who is responsible for its discipline, but has nothing to say as to its technical working; he must be supplied with a force of police. All troops, when once they have entered the bounds of the station, will be under his supreme command.

The experience of the Germans in the war of 1870 leads to the belief that it will be better to allow all trains to proceed at the same rate, in order not to add complications to work which must always be difficult to manage.

Supplies of coal will be frequently needed; bread must be carried in open trucks, or it will ferment.

Sidings between stations, long enough to hold a complete train, will be of very great service, but they must be provided with telegraphic communication.

Constant inspection of the line is most necessary.

The first technical works of construction and repair on the lines of railway will be carried out by the Engineers, but large constructions, and the full completion of such works as the Engineers have hurriedly begun, will be entrusted to civil engineers, with a staff of overseers and navvies. They will direct the construction of connecting and cross lines, of permanent bridges, &c.

(ii.) *Posts on the Line and Convoys.*—The "Line troops" will be responsible for the protection of all lines of communication which are not included within the territory of the Governors-General, or within the theatre of operations of the army.

For this purpose they will be organized with—

- (i.) A general staff, for the whole of the troops.
- (ii.) Local staffs to take charge of the various stages of the line.
- (iii.) Detachments of infantry, at the rate of 1,000 men per stage of 18 miles; their duty is to furnish escorts for convoys, to guard the posts, and to furnish the flying columns.
- (iv.) Detachments of cavalry, at least a section per stage, to furnish patrols and to collect requisitions.

The commanders of the posts on the line must be active and vigorous Officers, gifted with a talent for administration, and ready in emergencies.

The local staffs should be, as a rule, stationary, in order that they make themselves acquainted with the resources of the country, the power which the enemy has to trouble it, and the measures necessary to prevent him from doing so. Each commandant should have a fixed staff of clerks and orderlies, and should in this matter be independent of the passing troops.

All stragglers, sick, and detached men will be attached to the garrisons of the posts.

On taking over the charge of the line of communication the "Line troops" should—

- (i.) Take possession of all buildings within their reach which are suitable for stores, hospitals, and barracks.

- (ii.) Collect the greatest possible amount of transport.
- (iii.) Seize all mills and use them for the army.
- (iv.) Ascertain the resources available for the army in

- (a.) Provisions, such as flour, cattle, wine, beer, and spirits.
- (b.) Clothing; leather, cloth, flannel shirts, &c.
- (c.) Boots and shoes.

(v.) Possess themselves of all stores of wood which may be suitable for the construction of huts; these will generally be found along the course of rivers and canals.

(vi.) Seize all local stores of maps, in order to issue them to guides, escorts, &c. These will be found in the public offices, schools, libraries, road-surveyor's offices, &c.

(vii.) Select for the sites of magazines, ovens, and hospitals such positions, at cross roads, as are likely to be used as the starting-points or the junctions for the large parks of wagons. The necessity of escorting the sick and wounded to their destination must never be lost sight of.

Enlarge and improve the roads which give access to such points.

(viii.) Occupy the principal buildings, barns, stores, &c., which stand near to the station. Open out the roads leading to them, and, if necessary, pave them. With this object raise a corps of road-menders.

(ix.) Arrange for lighting the magazines, stores, &c., and provide them with fire-engines and a supply of water.

In addition to the combatant troops mentioned above the line must also be supplied with the following:

Detachments of train, to form convoys for requisitions; to include shoeing-smiths, collar-makers, and saddlers.

Military police, to take charge of localities and roads, and to provide against spies.

A medical staff, to take charge of the hospital material and to form and carry on temporary hospitals.

Engineers, to fortify the bridges and other important points on the line, and to build barracks.

Officers and men of the artillery, to look after supplies of ammunition, to pick up the arms on the fields of battle, and to arm the fortifications. Armourers and artificers for the repair of material.

Bakers, to make the bread for the army, in ovens which should be made at the various stations along the line. Butchers, with slaughter-houses along the line of rail. Men to bind and press hay, where the country offers a supply of forage. Shoeing-smiths, to make horse-shoes, and to arrange for roughing in case of snow or ice.

Cadres for the dépôts of stragglers and sick; Officers and non-commissioned officers of cavalry to take charge of the remount dépôts, with veterinary surgeons, shoeing-smiths, saddlers, and collar-makers.

Civilian workmen for the repair of material; for example, wheelwrights and blacksmiths, shoemakers, coopers, carpenters, and packers.

A postal and telegraphic staff.

Veterinary surgeons, to look after the cattle which may be collected, and also after the horse infirmaries.

Chaplains, to serve in the hospitals.

Commissariat Officers, assisted by civilian clerks, and provided with full statistics, to collect provisions and transport, and to form and administer the magazines on the line.

Civil engineers and their workmen, to rebuild bridges, make branch lines round forts which may be still occupied by the enemy, to build barracks and hospitals.

Road surveyors and overseers, to repair the roads ; the workmen will be requisitioned on the spot.

Mechanics acquainted with the use of road and traction engines, to direct the road transport, if at any time the railways should break down.

Interpreters.

Civil commissaries, knowing the language of the country, its system of legislation and of finance, to administer the government, to utilize the resources of the district for the army, and, if necessary, to forestall the taxes.

A Sanitary Commission, which shall follow the army, to disinfect the fields of battle, the camps, and the hospitals.

A Commission to send back the sick and wounded to the hospitals in rear, according as the beds become available.

All these must possess their own transport, or they will be useless for want of mobility. They will be as a rule under the General of the Communications, who will divide them and station them according to circumstances.

At the commencement of a war it would be well to mobilize 5 local Staffs, 3 line hospitals, 2 horse infirmaries, 3 depôts for stragglers, and 3 line magazines, as also a detachment of police and cadres of transport train sufficient for a convoy of 1,000 carriages for each army corps.

Hospitals.—The hospitals will be established near to railway junctions, or on the route followed by the grand provision convoys, in order that the latter may be available for the purpose of emptying them. Canals may also be used for the latter purpose. The convalescent depôts will be placed near the hospitals.

The depôts of medical stores and hospital material, with the reserve surgeons and apothecaries, must be provided with independent means of transport ; for hospital material which is not mobile is only a hindrance. The members of the Red Cross Society may march with these mobile depôts, or may be, for preference, employed in the hospitals on the line, or in assisting in the evacuation of the sick towards the mother-country.

The duty of disinfecting the fields of battle and the camps will be entrusted to a Sanitary Commission, composed of the best civil medical men, who will be supplied with sufficient money to pay for the services of local workmen, and to procure by wholesale the necessary stores of disinfectants. They will be responsible for the burning of the bodies of all animals, for the burial of men (having first, if possible, identified them), and for the organization and the closing of cemeteries.

Supplies.—The provision magazines should be placed near to the stations, in order to facilitate the despatch of supplies ; if this be not possible, it will be necessary to make sure that all necessary transport is at hand for the purpose of despatching and escorting their contents. The collection of provisions is but one-half of the problem ; it is not solved until means have been found to convey them to their destination. If supplies have to be sent by rail, care must be taken to make all arrangements beforehand with the staff of the railway, and to ascertain the probable time which they will take to arrive.

In order to unload the trains and to prevent accumulations at the stations, each army corps must be provided with at least 1,000 four-wheeled wagons, specially detailed for duty on the line of supplies. Of these, 400 will serve to fill up the train which marches with the corps, while 600 will be used to form temporary magazines between the "terminus" and the corps, as the latter marches farther and farther from the railway.

These parks must have military cadres ; should be divided into sections of 25 wagons each, and must be supplied with tilts, lifting-jacks, ladders, spare axles, and wheels, horse-shoes, and weighing machines. To each section will be attached a farrier, a collar-maker, and a representative of the

Commissariat Department. The drivers, if they are not soldiers, should wear a badge; they will receive pay and rations.

Along the whole length of road traversed by the convoys, especially between the "terminus" and the magazines which are nearest to the field army, shops should be established for the repair of vehicles, with the requisite number of wheelwrights and blacksmiths; a store for spare wheels and a supply of cart-grease will be attached to these.

It is very desirable to have two lines of road; one for going, the other for the return of the carts.

Requisitions.—In the interest of the Army itself requisitions should be used as little as possible, for they are the means of most rapidly expending the resources of the country in rear of it. Unsparing requisitions destroy all chance of future supplies.

It is wise to pay for all provisions, in order to induce the inhabitants to bring them in; while these payments may be covered by means of contributions levied on the whole theatre of war.

When troops and detachments are on the march and come for the first time into any locality, some system of requisition must almost unavoidably be used; but only the leaders of the column or detachment should be permitted to enforce it, while they should demand only such provisions and transport as are absolutely needed by their command, and should give a receipt for the same; these receipts should be audited every week in each local government. Wherever a commandant exists, either in a town or at a stage on the line, he only should be authorized to levy requisitions, which should be signed by him.

The burden of the requisitions will be diminished and more supplies will be obtained, if the army uses two roads; one for troops advancing to it, the other for those leaving it. In this manner also less work will fall on the roads; while the detachments who are advancing will thus not meet the wounded or sick, whose appearance may not improve their spirit.

Stragglers.—All stragglers and convalescents will be sent to the army in detachments, under the command of officers and non-commissioned officers.

Since the Army is a place where materials are consumed and not produced, every man sent forward to it must be well shod, armed, and equipped; every horse must be complete with its saddlery or harness, and newly shod.

Small Dépôts.—Even though the troops of the army of operations have been directed to draw their men and material, to replace that which has been expended, from their respective dépôts, they will seldom be able to obtain these supplies punctually, on account of the confusion and complications inseparable from their transit. It is therefore absolutely necessary that the Staff on the line shall deposit, along the line, at cross-roads and at obligatory points of passage (such as bridge-heads), stores of boots, horse-shoes, rifles, great-coats, saddles, harness, linen, and clothing. These stores will be available to re-equip wounded men when discharged from hospital, convalescents, and also to repair the total loss of any corps which may have been defeated or cut up.

Other dépôts will receive the surplus stores of the troops, or that part of them which is not to move on at present. These small dépôts should be provided with cadres, including buglers; they will be attached for subsistence and discipline to the garrison of the nearest post.

Dépôts of Cavalry.—The cavalry dépôts will take charge of all spare and sick horses. They will attend to the repair of saddlery and, if the country contains any supply of horses, remount dépôts can be attached to them. These dépôts must have ample cadres, and must above all be well supplied with veterinary surgeons, saddlers, collar-makers, and shoeing-smiths, who must be furnished with their various tools and with saddle-trees, hair for stuffing, picket-ropes, luges, bridles, marking-irons, &c.

Cavalry dépôts should, if possible, be placed in a country well supplied with forage, in the deltas of rivers, in meadows, &c.

Workshops.—Near to that end of the line of communications which is adjacent to the army large workshops must be formed :—

(i.) To repair wagons and carts.

(ii.) To make horse-shoes (or to rough them), both for draught and saddle horses.

(iii.) To repair and make saddles.

(iv.) To make boxes, casks, and cisterns.

Civil labour, under military control, will be as far as possible utilized in these workshops.

Workshops for armourers and artillery artificers will also be required along the line in order to repair the armament and to make up ammunition.

Ovens, slaughter-houses, and presses for hay will usually, if possible, be placed near junctions which are close to navigable streams.

Rivers and Canals.—Navigable water offers, except at the dry season or when there is ice, a valuable means of transporting cumbersome articles, such as hay, straw, fuel, and the heavy siege stores; especially if towing or traction by a sunken chain can be utilized. They are also convenient for the easy despatch of the sick and wounded.

There is generally little difficulty in constructing a line of rail along the towing path of a canal.

At the point where a canal joins a navigable river there will generally be found a considerable number of boats, large supplies of wood, planks, casks, and other stores for packing.

Navigable waters should be given in charge to engineers skilled in water transport, who will establish on them a system of tugs and barges. As such waters are generally supplied with a line of telegraph, this can be used to secure the safety of the water-convoys; but a marching escort should also be provided.

If a tug or barge be shod with iron along the water-line, it can be used even when the canal is full of ice. In dry seasons a careful use of locks and sluices will serve to keep the water at a sufficient depth.

At all points where cargo may have to be disembarked or trans-shipped, cranes, tackles, &c., must be provided, and also the men to use them.

Police.—The police duties connected with stragglers and marauders will be carried out by flying columns, from the officers of which courts-martial will be formed. These columns will scour the country in rear of the army, will arrest all stragglers, and will inflict summary punishment on marauders.

The various local authorities will be called upon to furnish lists of all billets occupied by soldiers, and to report their passage through their towns or villages.

Particular attention will be paid by the police to the volunteer ambulances, which are often the haunt of malingerers.

Roads and Convoys.—In spite of the existence of railways, roads are still needed for the communications of an army with its base; and they are especially valuable if suited for the use of road or traction-engines.

Much information is given by General Pierron with respect to these machines, as also with regard to the principles of the construction of roads, but the space at our disposal will not permit of the discussion of the question. It may be, however, of interest to learn that it is considered that 4 inches of road-metal will form a sufficiently firm basis for the use of traction-engines.

With respect to convoys, the following points are mentioned as the most important :—

The best system of supply by road is by relays, as this gives the least

annoyance to the drivers and allows them to look well after their animals. At each stage watering-troughs must be constructed, and barns or some shelters, dépôts of forage and shoes, and blacksmiths' shops must be provided.

In European war about 100 wagons (or 1 to every 25 men) will be required for each army corps. In wars outside of Europe at least one beast of burden must be allowed per combatant, when the country is not suited for wheels, or provided with navigable waterways.

Each wagon must be provided with reins, a lantern, and a tilt. Spare stores and shoes must be supplied for the vehicles, the harness, and the animals; grease, spare axles and wheels must also be provided.

The drivers must be placed under military discipline, and must be provided with badges and pass-books; they will receive a daily ration in kind, as well as pay and an allowance for shoeing their animals and for the repair of their carriages. The names of all drivers who are requisitioned must be noted, as well as that of their village, in order that the latter may be held responsible in case of desertion.

Shoeing-smiths, saddlers, and blacksmiths, with spare stores, must accompany each convoy.

At each stage the following should be supplied :—

- (i.) Men and means to shift the loads, and sheds to store the latter.
- (ii.) Blacksmiths' forges and saddlers' shops. Painters to mark the carriages with the nature and destination of their load.
- (iii.) A kitchen and shelter for the drivers. A sick stable for the animals, and veterinary aid. Stores of forage and provisions; spare stores; tilts and cases; and a dépôt of spare animals.
- (iv.) A camp to park the carriages, and sheds for the animals.
- (v.) Some arrangement for paying the drivers.

Local workmen of various trades may be employed in the workshops.

Rules for the March.—Large convoys should be broken up into sections, either according to the character of its load, or by the unit of the army for which it is intended; each section should have a distinguishing flag.

Each section, on the march, will be preceded by a body of pioneers provided with tools, to improve bad places in the road. At the tail of the column will march the spare animals and carriages.

If possible the load of each convoy, section, and cart should consist of some object complete in all parts and with all its accessories, in order that each on arrival may be at once available for use. Each section should also carry means for weighing and unloading.

Beasts of burden and carts should never be allowed to march together, for when the latter are stopped by any difficulty the former will be unnecessarily fatigued.

Each convoy should be accompanied by a party, who should move through with it to its destination; they should be provided with a way-bill showing the starting-point, the nature of each load, and its destination.

Before starting, the loads of the carriages and animals must be proportioned to the condition of the roads and to the weather. The next stage should be informed as early as possible of the departure of the convoy, in order that it may be ready to receive it.

Mounted men will precede the convoy, to give warning of bad places on the road, to extinguish all fires before the arrival of powder or ammunition carts, to requisition fresh animals, to clear the bridges or sound the fords, &c.

The next stage will be warned to prepare provisions and shelter, to procure guides for the next day's march, and to provide means of lighting if the convoy is not likely to arrive before night.

When within reach of the enemy, or in a hostile country, care must be

taken to reconnoitre both in front and in rear, either with cavalry, or by means of inhabitants of the country, whose families will be retained as hostages. No defile or other dangerous place should be entered until it has been searched by scouts, in front and especially on the flanks.

Reports.—The following system of reports is taken from the Russian Regulations, dated 12th December, 1876.

Commandants and the chiefs of stages will send in—

(a.) A daily report regarding—

The number of sick, of convalescents, and of those who have died in hospital.

Any excesses or disorders committed by the troops.

Any extraordinary events, such as the appearance of epidemic disease, fires in magazines, stores, &c. If nothing has happened, it should be so stated.

The disposition of the inhabitants.

(b.) Weekly reports concerning—

The date of the passing of couriers, of officers carrying treasure, of Generals, senior Officers, and of troops going to the army or returning; the passing of detachments, convoys, prisoners, &c.

(c.) A monthly report of—

The Generals and other Officers, and of all individuals connected with the army, who are residing in the locality of which they have charge.

Measures to be taken in Anticipation of War.—Want of space will not permit of the consideration of the conduct of a convoy (page 612); the direction of a convoy of pack animals (page 618); and some notes on escorts (page 631); though these are all interesting and worthy of notice; but it is impossible to avoid mention of the section on "The measures to be taken in anticipation of war." They are given as follows:—

Procure, if necessary from abroad, supplies of cattle, preserved provisions, and flour; in war there is no time to grind corn. Start manufactories of preserved provisions at home. Construct machinery to press hay and straw, and buy oats.

Obtain all possible information from persons inhabiting the enemy's country, from dealers in grain and in cattle, and from commercial travellers. Procure statistics of the towns and provinces, and print a sufficient number of copies of these for the use of the staff of the line of communications. Arrange that during peace engineers shall examine as to the best direction for lines of rail, which may be used to turn such forts of the enemy as command the lines of existing railway.

Buy warm clothing, gloves, fur-coats, sheepskins, and furs for the men employed on the railway, for troops engaged in sieges, for the posts on the line, and for the drivers of convoys.

Manufacture a supply of portable hut barracks, with stoves to warm them; provide Norton's pumps for wells.

Draw up lists of—

(i.) Engineers, to take charge of roads; and to construct barracks, magazines, and stores.

(ii.) Mechanics who can do skilled work.

(iii.) Interpreters.

(iv.) Civil administrators, who shall be employed to govern the enemy's country. These should visit the country during peace, and should study its law, administration, and resources. They must also know the language, and be acquainted with the system of taxation. They may be attached during peace to consulates, legations, or embassies.

(v.) Porters and professional packers; give them badges.

(vi.) Engineers to be employed on waterways; let them visit these during peace.

(vii.) Carpenters, blacksmiths, shoeing-smiths, saddlers, collar-makers, coopers, armourers, firework-makers, shoemakers, tailors, &c., to work in the great repairing workshops.

(viii.) Material and men required for workshops for boots near the "Magazine" stations; also the same to press hay and straw.

(ix.) Civil medical men and veterinary surgeons who may be called upon to do duty on the line.

(x.) The principal factories in the probable zone of operations, in order to use or destroy them.

(xi.) Residences of the principal local authorities (present and past) in the enemy's country, in order to seize their papers, which may be useful.

Prepare arm-chests to be deposited at various points on the line, to re-arm convalescents, stragglers, &c.; provide men at the hospitals to take charge of the arms of the sick and wounded.

Prepare a table showing the relative value of our money to that of the enemy or ally. Print also a note as to the system of taxation in the enemy's country.

Collect a complete set of maps of the enemy's country, especially of the means of communication, roads, railways, canals, and navigable rivers.

Cause the commissariat to study the resources of the enemy's country in provisions and transport; and also the markets in and out of Europe whence large supplies may be most cheaply obtained. Draw up a table of these foreign prices, and also of the brokers and ship-owners who can supply these stores.

Organize field-bakeries, to be placed along the line in groups. They must be sufficient in number that the movement of any group to the front or rear will not reduce the supply of the army below its requirements; *i.e.*, the remaining groups must be ample to supply all that is needed. Do the same with regard to the slaughter-houses which are to send up meat, packed in ice, to the army.

Prepare a cadre for escorts, and badges and pass-books for the drivers of requisitioned wagons.

Considering the important part which the weather plays in all operations in the field, it may be well to end this notice by mentioning the rules with regard to it which were regarded as trustworthy by Marshal Bugeaud, who found them in an old manuscript in a convent in Spain, and who made use of them for many years.

The weather, 10 times out of 12, during the (lunar) month follows that of the 5th day, if the 6th is like the 5th; and 9 times out of 12, follows the 4th day, if the 6th is like the 4th.

The extracts and details given in the foregoing paper will probably show sufficiently the general character of General Pierron's work, which must be of great value to those who desire to study the subject which it illustrates, since every statement in it is supported by quotations from men of experience in the various branches upon which it touches. Many parts of the treatise, of which the scope is enormous, have not even been touched upon, but it is hoped that enough has been brought forward to prove its importance as a book of reference on this most intricate subject.

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COLONEL v. LÖBELL'S¹ ANNUAL REPORTS UPON THE
CHANGES AND PROGRESS IN MILITARY MATTERS DURING
1886.

By Colonel H. HILDYARD, Highland Light Infantry.

THERE is no falling off from the high standard of excellence of its predecessors to be noticed in the thirteenth annual publication of Colonel von Löbell's very complete work on military matters, which treats of the year 1886. The constant and minute investigation of the strength, organic changes, and preparation for war of the armed forces of every State, and the publication annually of the carefully elaborated results, places it within the power of all who have access to this valuable work to follow the ever-varying phases of European politics with an accurate knowledge of what forces a rupture, under any given conditions, may be expected to bring into the field.

The most detailed reports treat, as might be anticipated, of the French and Russian Armies, which occupy together upwards of 100 pages, while next in order follow Italy and Austria. The armed forces of the smaller Powers are dealt with more briefly and in less detail, and of these, special interest is attached at the present time to the progress of military organization in Belgium, Turkey, and the neighbouring Balkan States, Servia, Roumania, Bulgaria, and Eastern Roumelia.

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Germany.

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1st. The Army section—deals with the organization of the Army in peace and war; the estimates for the permanent expenditure; recruiting and completion of the establishments; matters connected with the men dismissed to their homes, but liable to recall to the colours and with the Landsturm; the great manœuvres and exercises of reserve men; distribution of the troops; railways; road making and waterways; Etappen services; military conventions; special duties of the General Staff, including surveying, the railway troops, and the ballooning corps; literary and statistical matters; and business matters connected with the army.

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nation for Captains and First Lieutenants of artillery) ; completion of Officers on a peace strength.

3rd. The Cavalry section—deals with the special duties of cavalry ; the military school of equitation ; veterinary matters ; gendarmerie ; feldjägers ; posts ; field equipment of the army ; special duty of the train.

4th. The Artillery section—as heretofore, only that the provision of small arms and weapons, and the administration of the armourers is taken from it, and it takes over instead the combined Artillery and Engineer School and the Board of Examination for Captains and Lieutenants of artillery.

5th. The Engineer section.

6th. The Technical section, which remains the same.

The Military Economy department embraces five sections :—

1st. The Pay section.

2nd. The Supply section.

3rd. The Clothing section.

4th. The Store section.

5th. The Barrack section.

The department concerning the non-effective services comprises three sections :—

1st. The Pension section.

2nd. The section dealing with grants in support, other than pensions.

3rd. The employment section, dealing with the employment of Officers and men on the non-effective list ; military associations ; the execution of punishments ; detachments of workmen ; military churches ; military law ; courts of honour ; discipline ; pardons ; releases ; taxes ; marriages and elections ; genealogical lists ; decorations ; colours.

The independent Remount and Medical sections remain unchanged.

Creation of a Barrack Department.—By an order of March last the Engineer services were reorganized by the withdrawal of the staff and personnel, which had previously dealt with the charge and maintenance of buildings in the various garrisons. These duties have now been handed over to a department supervised by civilian officials. For this purpose the kingdom has been divided into barrack districts, each garrison having its barrack officials, who are under the Corps Intendants. In consequence of this reorganization a barrack section has been created at the War Department. The peace establishment of Engineer Officers has been commensurately reduced, and are distributed as follows :—

Distribution.	Field Officers.	Captains.	Lieutenants and Second Lieutenants.	Total.
Engineer corps and fortress inspections....	2	2	3	7
1st Pioneer Battalion	1	6	19	26
2nd Pioneer Battalion	1	6	19	26
Fortifications, Ingolstadt	3	4	8	15
Fortifications, Germersheim	1	2	3	6
Railway company	1	—	5	6
Officers attached	1	6	3	10
Total	10	26	60	96

Increase and Redistribution of the Army.—The Bill drafted in 1886 for the augmentation of the peace strength of the Army for the term of years from 1887 to 1894 became law last spring, and was given effect to without delay. The reasons for requiring the increase were the growth of the armies of neighbouring Powers, and notably France, since the previously existing establishments of the German Army had been fixed.

The following comparison will show the increasing superiority of the French Army in point of numbers:—

Date.	Germany.	France.	
	Strength of army.	Strength of army.	Percentage on population.
1870	378,069	358,846	0·93
1880	401,059	444,477	1·18
1881	427,274	—	—
1886 .....	..	471,811	1·22

By the new law the German Army numbers on a peace footing 468,409 men, approximately equal to that of France. This number is at the rate of 1 per cent. of the population, at which ratio the previous establishment was fixed in 1881, since which time the increase in population has allowed of the present augmentation without raising the ratio.

The distribution of the Army on the increased strength will be the following:—

534 battalions,
465 squadrons,
364 batteries,
31 battalions, garrison artillery,
19 pioneer battalions,
18 train battalions.

The increase is—Infantry, 5 regiments and 15 battalions; jägers, 1 battalion; field artillery, 24 batteries; railway troops, 9 companies; pioneers, 1 company; and train, 14 companies. With a view to reducing as far as possible the cost, 15 of the new infantry battalions will be distributed to regiments as fourth battalions, instead of being formed into additional regiments.

Training of Landwehr and Reserves.—The numbers of Landwehr and Army Reserve men called up for 12 days' drill in 1886, including non-commissioned officers, were as follows in the several arms:—

Infantry	91,700
Jägers and rifles	3,200
Field artillery	7,450
Garrison "	5,350
Pioneers	3,300
Railway regiment	570
Train	5,304
Total	116,874
And of the Bavarian corps..	10,400
Total	127,274

The number of men called up from the Ersatz Reserve was—

For a first drill of 10 weeks	13,998 men.
„ second „ 4 „	10,000 „
„ third „ 14 days	8,500 „
„ fourth „ 14 „	7,200 „
Of the Bavarian corps	5,950 „
Total	45,648 men.

The grand total, therefore of the Landwehr and Reserves, including the Bavarian corps called up in 1886, was 172,922 men.

Cost of the Armed Forces inclusive of the Navy.

In 1870 the amount was.....	272,478,397 marks.
„ 1880 it had risen to	403,425,826 „
„ 1886 „	446,288,673 „
The increase sanctioned in 1887 adds as a permanent charge about	23,000,000 „
And required to initiate it.....	24,000,000 „

As compared with France, the amounts per head of the population were in marks—

	Germany.	France.
1870	7·06	10·33
1880	8·92	20·43
1886	9·53	21·57

Belgium.

Recruiting.—A serious attempt has been made to introduce into the Belgian Army the principle of general obligatory service, with a decrease in the period with the colours. The King, in his speech on the opening of the Chambers, expressed the hope that a satisfactory solution might be arrived at regarding the recruiting question, and a scheme for giving effect to the principle alluded to above was introduced. Public opinion appeared favourable to such a measure, which it was thought would minimize the dangers from the extensive strikes, that had caused considerable anxiety. But the expectation that had been formed was destined to be disappointed, for the measure was thrown out.

Scheme for Supplying the Deficiency in Officers.—The number of Officers required to complete the Army on a war footing was, in 1885, 1,214. With a view to supplying these, a new class, termed Auxiliary Officers, has been created. They are to be obtained from selected non-commissioned officers who have served eight years, and who have passed an examination in the duties of the higher rank. These are given a diploma, and re-engage for five years, and they are then dismissed to their homes. This scheme may provide more or less for filling the deficiency in the numbers, but the method is certainly not calculated to produce properly qualified Officers for war purposes. With the same object in view Officers leaving the Service have been invited to engage to return to the Army in case of mobilization within five years of their leaving.

Mobilization.—The nucleus of a Reserve has been formed by the registration of the three last annual classes of the Militia that have completed their service with the colours. In consequence of this measure the allotment of

the annual contingents belonging to the several arms has undergone an alteration. In the infantry the three active battalions of each regiment are to be formed from the seven first classes, and the 4th battalion from the last six. Each of the latter is to be doubled, and a 5th battalion formed under the orders of the *dépôt* Major. The four active battalions of the Carbineer regiment will comprise the seven first classes, the 5th and 6th battalions the six last. In the cavalry the five squadrons will be formed by the seven first classes, the 8th, 9th, and 10th classes forming another, and the 11th, 12th, and 13th go to the train. In the field artillery the active batteries will be manned by the eight youngest classes, the rest going to the reserve batteries. The four horse artillery batteries include the first seven classes, the others forming the reserve batteries. In the garrison artillery the eight first classes form the active batteries, the remainder those of reserve. The six train companies are broken up on mobilization into subdivisions, formed from the ten first classes of the train, and the 11th and 12th of the cavalry. The 11th, 12th, and 13th classes of the train and the 13th of the cavalry form the *dépôt*. In the engineers the eight first classes form the three active battalions, the remainder another battalion. The special companies of engineers receive all their classes, and form an additional torpedo company.

Bulgaria and East Roumelia.

The result of the revolution in East Roumelia was to incorporate the Militia, which consisted of 4 infantry regiments of 4 battalions, 1 cavalry regiment, 1 artillery regiment of 6 batteries, and 2 pioneer companies with the North Bulgarian Army. This incorporation was not interfered with by the Conference of the Powers at Constantinople, nor has it been interrupted by the abdication of Prince Alexander. The combined army has been consequently reorganized, and its composition and strength on a peace and war footing were stated by the Austrian "*Armee-Blatt*" to be as follows in November last:—

Peace Strength.

8 infantry regiments of 3 battalions.....	480 Officers	13,813 men
4 " " " 4 " (East Roumelia)	312 "	9,256 "
Squadron of body guard.....	7 "	193 "
3 regiments of cavalry of 4 squadrons	84 "	1,851 "
3 " artillery of 6 batteries (6 guns)	78 "	2,310 "
1 battalion of pioneers of 6 companies	23 "	556 "
Flotilla	8 "	233 "

Total of standing army..... 992 Officers 28,212 men.

In war time each infantry regiment is composed of 4 battalions and an Ersatz battalion.

War Strength of the Field Army.

12 infantry regiments of 4 battalions	986 Officers	46,464 men
Squadron of body guard.....	7 "	193 "
3 cavalry regiments	84 "	1,851 "
3 artillery regiments	117 "	4,815 "
1 pioneer battalion	23 "	680 "
Flotilla	8 "	233 "

Total of field army..... 1,225 Officers 54,236 men.

The number of Militia to be counted on is said to be about 40,000. It is to be borne in mind, however, that the reserves of the East Roumelian regiments are not so efficient as those of Bulgaria, for they have only received a partial training as Militia. The formation also of the Militia battalions would be conducted under great disadvantages from the paucity of Officers, of whom there are not a sufficient number to complete the Field Army. Steps continue to be taken to perfect the army organization, and at the beginning of this year orders were given for the formation of a 4th battalion to the eight Bulgarian regiments, a 7th pioneer company, a garrison battery, and a disciplinary company. Considerable purchases of war material have been made, of which 48 field guns were delivered by Krupp, in July of last year, and 48 mounted guns with their equipment had been ordered; large stores of powder, cartridges, and shells were also awaiting delivery in Vienna, but the Austrian Government refused to allow of their being sent to their destination.

China.

In 1886 the reorganization scheme was extended to Manchuria. It is reported that this portion of the Chinese Army now amounts to 280,000 men, of whom 100,000 are armed with modern weapons, and the rest, some with muzzle-loading muskets of native manufacture, and some with pikes and scythes. About 30,000 men actually with the colours are provided with cadres from the Petchili Army, and have consequently been trained by instructors taught by Europeans. The Commander-in-Chief at Mukdem, Mandarin Mutuschau, takes great interest in their organization, and especially so as regards the cavalry. The force has over 60 Krupp field guns, and an arsenal has been established at Girin.

The seventh number of the "*Militär-Wochenblatt*," for 1886, has entered fully into the state of the army and fleet in the other provinces, and dwells particularly on the difficulties experienced by the European instructors, who are given no real authority.

Denmark.

A scheme for the improvement and completion of the permanent fortifications and exterior defences of the capital has been under discussion for some years past. In the Budget for 1886-87 considerable sums were included as special grants for commencing to put it in execution, and the following works were undertaken:—

Sea Defences.—1st. The construction of a coast battery north of Copenhagen, in the vicinity of Charlottenlund. The nature of the battery is a simple closed earthwork with wet ditches without flanking defences, and its armament is two 35½-cm. Krupp steel guns, and two armour-piercing 15-cm. guns. The battery forms the left flank of the sea defences and commands in part the entrance to the bay from the north. 2nd. The construction of a coast battery south of Copenhagen, near Kastrop on the island of Amager. This battery will be somewhat larger than the other, but of a similar nature, and will mount four 30-cm. and two 15-cm. guns. It forms the support of the line of sea defences on the right flank, and commands in part the southern entrance.

Land Defences.—The additions to these are limited to provisional works, so constructed as to be capable of development as parts of a system of a permanent nature. They are: 1st. Preparations for the inundation of the meadow land at Lyngby, with a view to forming an obstacle to the advance of an enemy upon the north front. The inundation will cover a large area of ground, the water for which is to be provided by the excavation of a canal of considerable dimensions from the neighbouring lakes, and dams will be con-

structed to ensure the water being retained to the necessary depth. A few small walled works are to be constructed to command the dams and to flank the whole of the inundation. 2nd. A fort at Garderhof, to the north of Jägersborg, at the west end of the inundation. It is to be constructed by private contribution, and will be a closed work with walled counterscarp and complete flanking defence. Both artillery and infantry will be under cover, the guns being placed in armoured towers or mounted on armoured carriages, and the small-arm defence provided for by quick-firing machine-guns in towers. Considerable progress has been made in the construction of the fort; but it will not be completed and armed before the end of 1888.

In October, 1886, a further special sum was demanded for the purpose of giving a further extension to the works, including a fort on the middle ground, the construction of which is to be extended over seven years, and some works on the right wing of the line of defence to hinder an advance between the inundation and the Sound. Besides these, the preparations for a second inundation are projected, to be connected with the first, and two provisional forts on the commanding heights of Thinghof to serve as a support to the field works to be eventually thrown up there.

The special credits in each year for the purposes indicated have amounted to nearly one-half of the entire ordinary budget for military and naval services. If the sums demanded for the continuation and completion of the works be granted regularly, the execution of the whole scheme of defence should be concluded in five years for the land front, and in seven for the sea front.

France.

The statistics of recruiting for 1885 show that there were 309,027 on the lists as becoming liable for service, of whom 6,675 did not come up when called. Dispensations from immediate service were granted for the following causes :—

Under Art. 17 of the Recruiting Law	48,832
Physically unfit	37,728
Only fitted for the administrative services	16,694
Put back from the years 1883-84	38,318

The contingent incorporated in the Army and Navy numbered 135,799; of these 11·30 per cent. could not read and write; their average height was 5 feet 4 $\frac{6}{10}$ th inches. It is worthy of notice that the annual class of 1885 was allotted on the territorial system by regions, a proceeding which was much questioned in the press, which contended that the recruiting law of 1872 required the active army to be completed from the entire country.

The contingent for the Army was distributed as follows :—

	1st portion.	2nd portion.	Total.
Of the 1885 class.....	90,216 men	36,641 men	126,857 men.
Put back from 1884	7,227 "	2,801 "	10,028 "
" 1883	3,067 "	1,043 "	4,110 "
	100,510 men	40,485 men	140,995 men.

It was allotted to the several arms as follows, after deducting 10,490 non-effectives, in the following proportions :—

I. <i>Infantry</i> —			
	1st portion.	2nd portion.	Total.
Line regiments.....	55,385 men	27,928 men	83,313 men
Rifle battalions	5,077 "	506 "	5,583 "
Zouave regiments	1,809 "	....	1,809 "
Algerian tirailleurs....	100 "	....	100 "
African light infantry	3 "	....	3 "
Foreign regiments	4 "	....	4 "
	62,378 men	28,434 men	90,812 men.
II. <i>Cavalry</i> (only 1st portion)—			
Cuirassiers.....		2,262 men	
Dragoons		4,676 "	
Rifles		3,423 "	
Hussars		1,964 "	
Chasseurs d'Afrique.....		629 "	
Cavalry school		8 "	
		12,962 men.	
III. <i>Artillery</i> —			
	1st portion.	2nd portion.	Total.
Artillery regiments.....	9,578 men	6,211 men	15,789 men
Pontoon "	698 "	....	698 "
Garrison artillery batta- lions	2,337 "	2,879 "	5,216 "
Artificers and labora- tory companies.....	104 "	....	104 "
	12,717 men	9,090 "	21,807 men.
IV. <i>Engineers</i> —			
Engineer regiments.....	1,871 men	881 men	2,752 men
20th Engineer Battalion	80 "	....	80 "
Railway companies	92 "	....	92 "
	2,043 men	881 men	2,924 men.
V. <i>Train</i> —			
	1,900 men	500 men	2,400 men.

The remainder were distributed, to the Marine Infantry 4,534, and to the Marine Artillery 1,105.

The incorporation of the recruits took place, for the 1st portion on the 1st and 6th December, 1886, and for the 2nd portion on the 27th November, 1886.

Reserves.—An order was published at the beginning of 1886 specifying the classes of men who are not ordinarily called up for army service, but who are considered available in time of war (*à disposition*). They have during their five years' liability for service with the active Army to attend for muster twice in their respective cantonal towns.

These classes are :—

- i. The one-year Volunteers who are allowed to postpone their service.
- ii. The men liable to be called up, but not incorporated in the Army.
- iii. Those discharged under ministerial decision.
- iv. Those excused service in peace time under Article 17 of the Recruiting Law.
- v. The men who are temporarily dispensed from the Service as being the only support of their family, under Article 22 of the same law.

- vi. The men who have attained the age for serving, but have been put back on account of physical reasons.

In each subdivision these men are allotted in peace-time in the following fixed proportions to the several arms :—

Infantry of the line, 66 per cent. ; rifles, 3 ; garrison artillery, 2 ; field artillery, 9 ; engineers, 2 ; train, 7 ; sections of labourers under the military administration, 4 ; sections of hospital attendants, 7.

The men who are allotted to the auxiliary services continue during the period of their liability at the disposal of the Minister of War, and in case of war they are employed, either with the administrative departments or as artificers or drivers for requisitioned vehicles. They are in no case to be allotted to the combatant branches, and during their twenty years of liability they are called up for muster five times.

Remounts.—The experiment instituted at the Suipe establishment in 1883 of buying young horses and keeping them there till as five-year-olds they are drafted to the mounted branches, has given such successful results that the system is to be extended to all the remount dépôts.

It has been decided that on mobilization mounted Officers, who have in peace-time to supply their own horses, will be furnished with such further horses as they may be entitled to at the public expense, as also all Officers of the reserve and territorial army.

Railways.—The concession for the important Paris State railway, which had been under discussion for a considerable time, was granted in April, 1886, and the works commenced. It will consist of the following sections :—

- 1st. A circular line commencing and ending at the Rond-point de L'étoile.
- 2nd. A line starting from the Place de Strasbourg, crossing the Seine, and ending at the Place Denfert.
- 3rd. A line from the Carrefour Drouot to the Place de la Bastille.
- 4th. A line from the St. Lazare Station to the Station du Nord, where it joins the circular line.

The whole system has a length of 33 kilos., and not only connects the different sections of the State railways, but facilitates the change from one to another of the several existing lines having their termini in the city.

The Superior Railway Committee has been reframed, and its duties regulated so as to bring them into harmony with the various committees and commissions connected with the several arms and branches of the service which operate under the Minister of War. It is composed of the Chief of the General Staff as President, and a General, being a member of the General Staff Committee, as Vice-President ; the members are 3 officials from the Public Works Department, 2 representatives of the chief railway companies, a senior Officer of the artillery, an engineer Officer commanding a railway battalion, an intendants official, and a naval Officer ; the head of the railway section of the General Staff acts as Secretary.

The general duties of the Committee are to deal with all questions connected with the utilization of the railways by the Army, the preparations for mobilization, the concentration of the troops, and the direction of the transport in war, as far as the base of operations. The detailed questions to be worked out are the laws, regulations, instructions, preparations, projects, works, and costs relating to :—

- 1st. The means of transport and the changes required in the interests of military transport.
- 2nd. The disposition and design of stations, platforms, side lines, magazines, hospitals, victualling stations, branch lines for the connection of military establishments, and the connection between one line and another.
- 3rd. Contracts and agreements with the railway companies.
- 4th. Formation and instruction of the railway troops.

5th. The projection of railway lines from a strategical point of view; choice of trace, and urgency of construction.

6th. Practice by the troops in loading trains.

7th. Military studies of foreign and home lines with a view respectively to their destruction and renewal.

8th. Preparations of time tables.

Balloon.—The balloon service has been reorganized and placed under the 4th Bureau of the General Staff. The central establishment is at Chalais, where a special staff is maintained, and where there is a room for studies and experiments, an arsenal for preparing the material, and a school for training Officers and men detached there for instruction. Balloon parks will also be formed at each of the Engineer Regimental Schools and in certain garrisons to be fixed by the Minister of War.

Ministry of War.—The central department has been modified in its organization, by the creation of technical sections, which are attached to the several branches, and have for their object to study special technical subjects connected with the several arms, and to dispose of the questions arising out of them.

For the infantry there are three bureaux in the section dealing respectively with its material, arms, and training, and there are two superior Officers and six Captains employed in connection with them.

In the cavalry section there are three commissions dealing with the training and the remounts, the gendarmerie and the veterinary branches respectively, and the number of Officers is 2 superior, 4 captains, and 4 veterinary surgeons.

The section for the artillery is in six subdivisions, treating respectively of the personnel, the material, small-arms, the equipment and armament of fortified places, and the construction of machines. The archives, library, and museum are attached to the section. It comprises 14 superior Officers, 23 captains, and 1 engineer.

The engineer section employs 6 superior Officers, 5 Captains, and 6 gardes du génie.

The technical section for the medical branch has four bureaux, dealing with medical science, sanitation, material, and statistics respectively.

The General Staff section includes three subdivisions for railways, telegraphs, and matters relating to training in the military schools. There are 14 superior Officers, 10 Captains, and 2 recorders employed in it.

The several committees and commissions that operate under the orders of the Minister of War have been rearranged and placed on a new footing.

The fortifications committee was replaced by an engineer committee; the commissions for the care of horses and for the gendarmerie were done away with.

Consultative committees were created for the infantry, the cavalry, the artillery, the engineers, and for the intendance and sanitary services. Each of these consists of 9 members, including the president and secretary, of whom 6 belong to the arm concerned.

The secretary acts in each case as the head of the technical section concerned. All the members are Generals or Colonels, or the officials corresponding to these ranks, and are drawn from the Paris Military Government; and one-half of them are replaced annually.

The Conseil Supérieur de la Guerre consists also of nine members, exclusive of the Minister of War, who is President, and the Chief of the General Staff as reporter.

The General Staff.—Instructions were issued in December last regarding the organization and duties of the staff that altered materially the regulations previously existing. The General Staff comprises the following:—The

maison militaire of the President, the cabinet and orderly Officers of the Minister of War, forming his personal staff; the General Staff of the Minister of War; the General Staffs of the Military Governments of Paris and Lyons; the General Staffs of Army Corps, divisions, and brigades; the General Staffs of the territorial divisions and subdivisions; those of the fortified places, of the Field-Marschals and specially employed Generals, and of the Officers holding commands in the artillery and engineers. The military attachés abroad are also included.

A General of division is chief of the staff to the Minister of War, a Major-General or Colonel to the Military Governments and Army Corps respectively, superior Officer to divisions, artillery brigades, and commanding engineers. Brigades have only one orderly Officer.

The staff is generally recruited from candidates who have gone through a two years' course at the War School (answering to our Staff College), and passed the necessary examination. Officers may, however, qualify by passing the examination without undergoing the course. A certain number of Officers are annually selected to do duty on the General Staff for the space of twelve months, during which time they have to be attached for two months to each of the two arms to which they do not belong. Generals are authorized to select their orderly Officers from the captains or lieutenants who have graduated. The term of an appointment on the staff is limited to four years.

The duties of the General Staff in peace are the following:—The chief of the staff directs on his own responsibility the general duties, and has the powers of a Commanding Officer over the personnel working under his orders. The assistant chief of the staff assists his chief in the details of duty, and takes his place in his absence. The General Staff of an Army Corps is divided into two sections, of which the 1st, or active section, deals with general correspondence, training, operations, personnel, military law and administration; the 2nd, or territorial section, devotes itself to recruiting, organization, mobilization, artillery and engineer establishments, and fortifications.

In war, to the category of General Staff Officers have to be added those employed on the railways and lines of communications, and in connection with the territorial commands. The increased number is furnished by Officers holding the General Staff certificate drawn from the active Army, the reserve, and the territorial Army. The duties of the staff in war are laid down in detail, that of each command being divided into two portions for field and office duties respectively. The latter are in an Army Corps subdivided into three bureaux; the 1st deals with matters relating to the personnel and the material, including organization, personal questions, ammunition, supplies, war material of every description, correspondence, headquarter duties; the 2nd, with intelligence duties and political matters; and the 3rd, with the operations.

The staff of each Army Corps (excepting the XIX, that has two more Officers) consists of 2 Colonels or Lieut.-Colonels, 3 Majors, 3 Captains, 2 Orderly Officers, and 3 archivistes or keepers of records.

The Artillery of each Army Corps (excepting the VI, which has an additional captain) has 1 Superior Officer, and 1 Orderly Officer. There is no special staff for the engineers of an Army Corps.

Each infantry and cavalry Division has 1 Superior Officer, 1 Captain, and 1 Orderly Officer.

Special distinctive marks have been allotted to the staff besides the previously existing shoulder cords, which are now only to be worn in full dress. In the field, on the march, and at manœuvres, they are to be distinguished by a band on the left arm of the coat, great-coat, and dolman, and by the facings of the cloak. The arm bands are of different colours; for Officers on the

personal staff of the President and Minister of War, white silk, for those of the latter's General Staff and that of Armies, white and blue : for those of Army Corps, white, blue, and red ; for those of Divisions, scarlet ; and for those of Brigades, blue silk. The bands are furnished with distinctive decorations, and those for the Staff Officers of Army Corps and Divisions have further the numbers of these on them.

The decorations consist of lace, grenades, stars, crossed cannons, &c.

Field Manœuvres.—Orders have been issued that in every considerable garrison exercises in field manœuvres are to be practised with the three arms combined, so as to afford Officers an opportunity of becoming acquainted with other arms than their own. The General Officer Commanding is responsible for arranging the exercises according to the constitution and strength of the troops available and the nature of the ground ; and no extra expense is to be incurred.

In the great manœuvres two Army Corps were exercised as corps for twenty days, ten by divisions, and six by brigades, the duration of the manœuvres being in each case limited to fifteen days. Two divisions, however, did not take any part in them as they were retained as the Paris garrison. The infantry regiments had each their three battalions, the companies of which were made up by the help of reservists to 165 men. The brigades exercised independently had each 2 infantry regiments, 2 squadrons, and 2 batteries ; the divisions, 4 infantry regiments, 1 to 2 battalions of rifles, 1 cavalry regiment, and 4 batteries. Fortress manœuvres were also executed at Verdun, Toul, and Belfort, the battalions which would form the garrisons of these places in war being sent to them for the purpose.

Cavalry.—A new Lieutenant-General's command has been created in Algeria, as commandant of the whole force of cavalry in that country, and the cavalry in each of the three provinces placed under the command of a Major-General.

The formation of a 4th Spahi regiment has been ordered, in every way similar to those previously in existence. The first three squadrons were formed at once from the subdivisions of cavalry of the mixed companies in Tunis.

Manœuvres were executed by two cavalry divisions, each of 24 squadrons of 100 horses, formed in 3 brigades of 2 regiments, with 3 horse batteries of 6 guns, 1 telegraph section, and 3 ambulances. The first six days were occupied with regimental and brigade exercises, the three following ones with exercises of independent divisions, the two succeeding days with manœuvres of one division against the other, and the next and concluding day with the movement of the combined divisions against the flank of a line formed by infantry and artillery. The rest of the cavalry was exercised by brigades for eight days.

Artillery.—In place of the carbine previously carried by the field artillery, the batteries, ammunition, and park sections are in future to be armed with a revolver and sword of a new pattern.

Special artillery manœuvres were executed at Chalais by 10 field batteries, 6 horse batteries, and 4 ammunition sections of war strength, representing the artillery of a mobilized Army Corps, two extra horse batteries taking the place of two field batteries. During the first four days exercises and practice were carried out by groups of batteries ; the remaining days were devoted to tactical manœuvres.

École Supérieure de Guerre.—This school for the training of Officers for the staff has been reorganized. Candidates for entrance must not be more than 32 years of age on the 31st December of the year of entry, and must have at least five years' service, of which three at regimental duty. The professors for surveying and topography have been abolished, and lectures are to be

given in these subjects by Officers, attendance at which is to be optional; courses in English and Italian have been instituted, and the subject of the application of science to the art of war introduced. Four riding masters have been reduced.

The teaching staff will in future be the following :—

Military history, strategy, and tactics.....	2 Staff Field Officers.
Applied infantry tactics.....	2 infantry Field Officers.
" cavalry "	2 cavalry " "
" artillery " and matériel	2 artillery " "
Fortification	2 engineer " "
Staff duties	2 staff " "
Geology and geography	2 " " "
Administration	2 sub-intendants.
Riding	1 squadron commander and 3 captains of cavalry.
German.....	4 professors, civilians or Officers.

In addition, periodical lectures are given by the chief of the 1st bureau in the General Staff section on mobilization; by the chief of the 4th bureau on railways; by a medical Officer of the Paris garrison on hygiene and sanitation; by a field Officer or superior official of the post and telegraph department on telegraphs. The above subjects are obligatory; Russian, English, Italian, topography, and surveying are optional. The lectures on the application of science to the art of war are given by the Officers of the several technical sections of the War Ministry.

The number of students admitted last autumn was the following :—

Infantry.....	4 Captains	38 Lieutenants.
Cavalry	1 " "	7 " "
Artillery	3 " "	11 " "
Engineers	4 " "	1 " "
Marine infantry	1 " "	— " "
Total	70 Officers.	

Non-commissioned Officers.—In view of the increasing importance of retaining non-commissioned officers with the colours beyond the period of their obligatory service, various privileges have been accorded to those of them who re-engage. They will be excused wearing their packs at ordinary drills, and will only carry them on the march, at parades, and during the manœuvres. They are to be saluted by non-commissioned officers of the same rank who are not re-engaged, and they are to be allowed a box, provided at their own expense, in barracks, for their kit, &c. They will be distinguished by a band of red silk and gold or silver lace at the top of their facings, instead of the chevrons of rank.

Officers.—Hitherto the selection of Officers of the several ranks for promotion *au choix* has been effected by a commission that met annually in Paris and was composed of the Military Governors and Army Corps Commanders, which necessitated the prolonged absence of the latter from their commands. By a decree changing this arrangement, the necessity for this has been obviated, and the immediate superiors of the Officers concerned have been given an increased voice in the matter. In each Army Corps, in the Military Government of Paris, in the Military Schools, and in the Garrisons of Algeria, Tunis, and Tonkin, special regional commissions are to be instituted, to which the Army Corps and Divisional Commanders, the Military Governor of Paris, and the Commander-in-Chief of Tunis belong permanently. The Inspector-

General of the troops concerned and the two superior Officers of the candidate next senior to the permanent members join the commission annually. The promotion lists for Officers at the military schools are prepared by a commission composed by the War Minister, the Inspector-General, and the Commandants of the schools; in the case of the Staff school, the chief of the staff is also a member. In Tonkin, the commission is formed of the General commanding the division and the brigade commanders.

Annually, before the inspections take place, the Minister of War settles the minimum seniority below which candidates are not to be taken for each arm and each rank, and the number to be included in the lists. The several commissions then draw up the lists of the Officers they consider best qualified for promotion, and these lists, when approved by the Minister, are published in the official paper. The lists for the higher ranks, from Colonel upwards, are framed by a special superior commission composed as heretofore of Corps Commanders, the Military Governor of Paris, and the chief of the staff, who usually assemble at the capital for the purpose in November. The regional commissions further submit lists of Officers recommended for appointment to the Order of the Legion of Honour, and promotion in it as high as Officer.

Territorial Army.—There was last year an increase of 132 Officers to the infantry, and 97 to the cavalry, and a decrease of 22 in the artillery. The numbers in each arm in May, 1886, were: infantry, 9,519; cavalry, 1,419; artillery, 1,880; engineers, 529; train, 370; medical department, 2,622; intendants, 199; and Officers of Administration, 1,220. The grand total of Officers and officials was 20,692.

Instructions regarding the calling-up of Officers and men of the territorial army have been issued. Every man during his five years' obligation will be called up to one exercise, the half of each of the two youngest classes being called up every year. The commanders of the units to be formed on these occasions must come up two days before the men, and remain two days after they are dismissed. The other Officers, except the subalterns, remain one day longer. The duration of the training is thirteen days, including the days of arrival and dismissal.

The Lieutenant-Colonels of infantry and artillery as well as the engineer battalion commanders are called up yearly; the rest of the Officers only once in two years. Officers of the Artillery Staff and those attached to the General Staff are only called up specially by ministerial order. A considerable number of dispensations are allowed to the men for various causes. Every man is medically examined on coming up.

Italy.

It was stated by the Minister of War in the Chamber in December last that 500,000 men fully equipped and complete in every particular can at any time be placed in the field. The number of the class called up to supply the annual contingent was 359,302, including 10,213 postponed from previous years; necessary reductions brought this number down to 344,521, accounted for as follows:—

Struck off for special reasons.....	4,483
Found unfit	69,656
Postponed for one year	74,448
Not forthcoming	11,055
Allotted to the 1st category	79,446
" 2nd "	20,372
" 3rd "	85,061
Total	344,521

Remounts.—The system of breeding horses at remount dépôts allows of 3,000 horses being delivered annually for army purposes. Of these, 2,500 are required for the cavalry, leaving 500 only for the artillery and engineers, the requirements of which are completed by purchase in the kingdom. Purchases abroad should no longer be necessary in the ordinary way; but on account of it having been decided to mount infantry captains and lieutenants of the artillery, engineers, and medical service on Government horses, some have lately had to be purchased in Hungary.

A new regulation has been issued regarding the enrolment of horses required on mobilization. To ensure the prompt delivery of the horses, contracts are made with owners. In every divisional district and for each Alpine regiment a commission was assembled to conclude the contracts for the horses required. The duration of the contracts was generally one year; the premium to be paid 50 lire, and one of the conditions made was that horses for the infantry and bersaglieri should be delivered on the second day of mobilization, and those for the Alpine troops on the fourth day. The price agreed upon is not to exceed 1,500 lire. The object to be attained by this regulation is limited to supplying the infantry with their quota of horses; and it is the intention of the War Minister to extend it so as to meet the requirements in this respect of the field artillery and administrative services. The money voted for the purpose for 1886-87 provides for 12,000 horses.

Rearmament of the Troops with a Repeating Rifle.—The progress made last year with the solution of the magazine rifle question in Germany, Austria, and France led to a revival in Italy of the trials on the subject, which had previously been dropped. At the beginning of October an Officer from each of 6 infantry, 3 bersaglieri, and 3 Alpine battalions, was sent to Turin to be trained in the manipulation of a weapon called the Vitali rifle, an adaptation of the Vetterli now in possession of the troops, invented by an artillery Officer. The following month exhaustive trials were made with it in the battalions named, which led to its adoption. A special credit has been granted to meet the expense of its introduction, which will be gradual, but the whole of the first line will be armed with it by the middle of 1888, after which the mobile and territorial militias will be taken in hand.

Permanent Defences.—Large sums have been voted and expended on these, of which the greater portion has been devoted to coast defences. On the land side the programme included the improvement and completion of the system of defences in the passes of the Ligurian Apennines and the Western Alps; the fortification of Verona and the construction of defensive works in the valleys of the Oglio and the Adda; in the vicinity of the Sette comuni, and in the valleys of the Cadore and the Brenta.

The programme of the coast defences, for which money was voted in July, 1885, included the following items:—

- 1st. The strengthening of the works in the the harbours of Bado, San Stefano, Talamone, and Gaeta.
- 2nd. The improvement of the defences of Genoa and Venice. At both places new batteries will be constructed, and at Venice two new forts constructed in connection with the entrenched camp of Mestre, and the number of steam tugs and lagoon boats increased.
- 3rd. The construction of a number of new coast batteries, intrenchments, and military roads at Messina.
- 4th. The building of two new forts on the island of Elba.
- 5th. The completion of the fortifications on the island of Maddalena and at Tarento.
- 6th. The construction of a new enceinte at Spezzia, and the completion of the forts both on the land and sea fronts.
- 7th. The completion of other works for coast defence of minor importance.

In the interior, progress was to be made with the works on the heights at Capua, and with the line of forts and enceinte at Rome.

In December it was stated by the War Minister that Spezzia, if not absolutely complete, was in a sufficiently advanced state to serve as a base for the operations of the fleet and to cover the arsenal. At Messina some of the individual works are finished; but it must be some years yet before it can be reckoned upon as a strong place.

A law previously in force in what was formerly Sardinia regarding the construction of buildings in front of the fortresses was applied to the entire kingdom. It embraces in its provisions a zone extending to a distance of 1,000 metres, divided into three belts of 250, 250, and 500 metres respectively. The first in the immediate proximity of the fortress is to be kept absolutely clear; on the next the materials of constructions of whatever kind are restricted to wood; in the third they may be made of thin masonry.

Coast Defence Corps.—A special corps has been created for work in connection with local coast defence, the Officers of which have an establishment of 3 captains, 3 frigate captains, 4 corvette captains, and 10 subordinate officers. The corps is intended to play a similar part in coast defence to that of the Alpine troops in frontier defence. A portion of the corps is employed in the arsenals, and the hydrographer's office.

Pigeon Stations.—Twelve stations are established in various parts of the kingdom under the supervision of the engineer territorial command at Rome. There are stations also at Massowa and Assab for inter-communication between those places. Each station is divided into as many groups as there are places to be communicated with from it, and these groups ply the same line always. Communications between the island of Maddalena and Rome (240 kilos., all sea) has been kept up in all weathers, and pigeons have arrived close to Naples from Cagliari (450 kilos.). During the squadron manœuvres reports were sent by pigeon, and arrived often many days before the despatch vessel sent at the same time.

Strength of the Armed Forces.—The actual strength of the permanent Army serving with the colours is 233,197 of all ranks.

The total numbers on the rolls of the permanent Army on	
the 30th June, 1886, was	902,112
Ditto mobile militia	285,307
Ditto territorial militia	1,309,709
Grand total	2,497,128

In this number are not included 2,052 Officers of the auxiliary services, and 3,693 Officers non-employed.

The 902,112 men of the permanent Army are distributed as follows :—

Officers	17,358	Sanitary companies.....	10,821
Infantry regiments.....	298,720	Supply companies	4,253
Military districts	312,273	Invalid and veteran corps ...	426
Alpine regiments.....	26,340	Remount dépôts	250
Bersaglieri	45,774	Penal companies	1,552
Cavalry	30,244	Military prisons—	
Artillery	99,487	Administrative staff	371
Engineers.....	23,594	Prisoners	1,257
Carbineers	23,721		
Military schools, &c., and			902,112
instructional formations....	5,671		

It must be borne in mind, however, in looking at these large numbers,

that at least a quarter of the permanent Army and the mobile militia have never served at all, and another quarter only for a period under six months. Of the territorial militia about a half have not served.

Mobile Militia.—The distribution of this by ranks was—

Officers and Ersatz Officers	2,625
Non-commissioned officers	4,370
Corporals	26,867
Privates	251,445
Total.....	285,307

The organization was completely changed in 1886, and the following formation introduced :—

Infantry—

- 90 battalions of 4 companies = 30 regiments.
- 13 battalions of 4 companies, excepting the two Sicilian battalions that have only 3.
- 22 Alpine companies, 1 company answers to every permanent battalion.

Artillery—

- 12 field artillery brigades, each of 3 batteries, and 1 train company.
- 1 special Sicilian brigade, and 1 train company.
- 23 garrison artillery companies.
- 4 mountain batteries.

Engineers—

- 14 sapper, 2 miner, 2 railway, 1 telegraph companies.
- 3 pontoon and 4 train companies.
- 12 sanitary companies.
- 12 supply „

There is further the special Sardinian militia—

- 9 infantry battalions of 4 companies.
- 1 battalion of 4 companies.
- 1 cavalry squadron of 4 subdivisions.
- 2 field artillery batteries.
- 2 garrison artillery batteries.
- 2 train stations.
- 1 sapper company.
- 1 sanitary „
- 1 supply „

It is intended in the event of mobilization to draft to the mobile militia from the active army Officers to command every company, for which purpose about 532 Captains would be required.

The foregoing organization of the mobile militia shows a reduction in the number of formations, which was very necessary, looking to the actual numbers of men available. The preceding organization had been based on a yearly contingent of from 80,000 to 82,000 being available for purposes of recruiting. But as a matter of fact this contingent at the present time, so far as it affects the mobile militia, does not exceed 65,000, and it will not do so for some years to come. And in addition to this the contingents now forming the reserve are so small that the youngest class of the mobile militia would be required to complete the permanent army. Taking these facts into consideration, it has, therefore, been wisely decided to reorganize the cadres on a basis to accord with the actual circumstances, and to provide for each company of infantry being 200 strong.

Territorial Militia.—According to Lieutenant-General Torre's report, the strength in Officers and men was as follows on the 30th June, 1886:—

Lieutenant-Colonels	91
Majors	232
Captains	819
Lieutenants	1,313
Sub-Lieutenants	3,010
Total Officers.....	5,465

The value of the corps of Officers would, it has been pointed out, be higher if more care were taken in the selection of candidates for first appointments, and only those were taken who have served in the permanent army.

Non-commissioned officers	14,324
Corporals	52,453
Privates	535,477
Men who have never served	634,990
Total men	1,297,244

The men of the infantry and the bersaglieri belonging to the 1st and 2nd categories of the classes 1850 and 1853, and to the 3rd category of the classes 1859, 1860, and 1861, were called out for fifteen days' training. The result was reported to have been very satisfactory; the men came up well, and the training went off smoothly.

Communal Militia.—The law of 1876 authorized the military and civil officials to call up men who have been dismissed to their homes for local garrison duties. The object of the provision was to allow of the whole of the permanent army being withdrawn for manœuvres, for it was stated by the War Minister that the daily garrison detail throughout Italy amounted to not less than 12,000 men. In 1886 it was for the first time enforced; but only partially as an experiment. The satisfactory results obtained have led to an order being given for rolls to be drawn up in each military district, with a view to the extension of the practice.

Mobilization.—A practical mobilization of the garrison artillery was practised in July, 1886, when the order was sent by telegram for three completed battalions to be despatched from Genoa, Alessandria, and Milan, to the forts of Giovo, Exilles, and Moncenisio respectively. The matter was not kept a secret, and the order was therefore expected, which must detract in some degree from the credit due for the promptitude with which it was given effect to; it is nevertheless a proof of the complete state of preparation that they were ready to move completely equipped in from six to eight hours after the receipt of the order.

Austria-Hungary.

In June, 1886, a law for the regulation and organization of the Landsturm was promulgated. By its terms every citizen capable of bearing arms between the ages of 19 and 42, who does not belong to the army or navy, including their reserves, or to the Landwehr, is liable to service in the Landsturm. The obligation of Officers and military officials who have completed their service in any of the foregoing formations is extended up to the completion of their 60th year. Those liable to service in the Landsturm are divided into two portions:—1st, those who have completed their 19th year, until the end of their 37th year; the 2nd, those between 37 and 42 years of age.

The Landsturm is liable to be embodied only in the event of war being imminent, or when the country is actually engaged in war, and may be kept up for the duration of hostilities. The terms of service in the other formations remain unaltered: with the colours, 3 years; in the reserve, 7 years; and in the Landwehr, 2 years; or in the Landwehr alone for 12 years; but by a provision that makes the first portion of the Landsturm liable for the first five years of their service with it to be employed with the field army in the event of mobilization, the total period during which they are liable for active service abroad has been extended from 12 to 17 years, a most important change. The material increase to the active army by this measure may be estimated from the circumstance that on an average about 92,000 men annually complete their period of 12 years' liability.

The Landsturm has been allotted to the commands and battalion districts of the Landwehr, the designation and battalion number of which the Landsturm formation bears. Upon mobilization it is intended that the men of the Landsturm shall come up in their own districts, and after those required from the first portion for the active services have been drafted to them, the remainder are to be distributed between marching battalions, for the purposes of garrison, fortress, and *etappen* duties, and territorial battalions to be formed at the headquarter station of the district. The former battalions will consist of 4 field companies and 1 reserve company, each of 4 subdivisions, the latter of from 3 to 6 field companies, each of from 3 to 6 subdivisions. The field companies of the marching battalions are to be formed as a rule from men of the first portion of the Landsturm, and will be taken exclusively from those who have served in the Army after the wants of the active army have been supplied; the reserve company is to take such trained men as remain available, and be completed by untrained men.

A cadre is to be maintained in peace for each battalion, marching and territorial, forming an independent Landsturm detachment under the orders of the Landwehr district command.

The Hungarian Landsturm law is identical with the Austrian in all material points, but whereas the former provides for cavalry as well as infantry formations, the Austrian is limited to infantry. In Hungary, besides two infantry battalions and one reserve company to each Landsturm district, there are 40 independent squadrons of Hussars, besides 20 reserve half-squadrons.

Strength of Army and Landwehr.—At the commencement of 1886 the total strength of the armed forces of Austria and Hungary, exclusive of the troops locally raised in Bosnia and Herzegovina, was 1,318,391.

Of these the Officers of the Army numbered....	18,870
Other ranks.....	872,579
One year volunteers	3,789
Chaplain's department	7,606
Austrian Landwehr	220,000
Hungarian „	195,547

Hungarian Landwehr Infantry.—Hitherto the formation has been in 92 independent battalions, to be formed into half-brigades in time of war. By the new organization the formation is to be by half-brigades in peace-time also. Of these there are to be 28, each of 3 or 4 field battalions, and in war 1 reserve battalion in addition. Each battalion consists in peace-time of the staff and, with two exceptions, of 1 cadre company, and in war, of the staff and 4 field companies, the reserve battalion having 3 to 4 reserve companies.

In peace the whole of the stores, equipment, and transport material for each battalion on mobilization is kept at its station in charge of an Officer;

those for the staffs of the half-brigades at the stations of those battalions that are detailed to furnish the personnel for those staffs. There is a commandant to each half-brigade district, assisted by an adjutant, a recruiting Officer, and an Officer for administrative duties.

The training of the men who join the Landwehr direct is for a period not exceeding 20½ months, commencing with recruit drill, from the 6th October, when they are called up, to the end of November, and being continued with the cadres until the 15th July of the second year. During the period of their liability they are subsequently liable to five trainings of thirty-five days each; the men who pass to the Landwehr from the Army have to attend two such trainings. The battalions of each half-brigade are assembled together for a period of eight to ten days, for the purpose of practising route marching. There is a special course of training for non-commissioned officers for each battalion, lasting four months, and they are subsequently united by half-brigades. There are also special courses for drummers and buglers with each half-brigade, as well as ambulance and pioneer classes in each Landwehr district.

Romania.

The Army is composed as follows :—

Infantry—

Rifles	4 battalions
8 line regiments of 2 battalions	16 „
31 Dorobanz regiments of 2 battalions..	62 „
1 ditto of 3 battalions and 1 independent battalion	4 „
	<hr/> 86 battalions

Cavalry—

3 Rosiori regiments of 4 squadrons	12 squadrons
12 Kalarasch regiments and 2 squadrons	49 „
	<hr/> 61 squadrons

Artillery—

8 field artillery regiments	50 batteries
Siege artillery	2 companies

Engineers—

1 regiment of 4 battalions	20 companies
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<i>Train</i>	4 squadrons
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with a combatant strength of 86,000 infantry, 9,150 cavalry, 300 field guns, 500 garrison artillery, 5,000 engineers, giving with the train and administrative services a total of about 140,000 men.

The Ersatz formations are 41 battalions, 15 squadrons, 8 batteries, 1 engineer battalion, numbering about 45,000 men. Arms and equipment are available for at most 230,000; but the total number of men who have served would allow of as many as 380,000 men being made available.

Russia.

The occasion is taken to deal at considerable length with the existing organization resulting from the changes introduced by General Wannowski, when Minister of War in 1881, which have now been carried out. Space will not permit of more than an imperfect *résumé* of the actual composition of the existing army, and much that is of interest must necessarily be omitted.

I. *Infantry.*

1. *Active Regiments.*—12 Guard, 16 Grenadier, and 164 Line regiments, of 4 battalions, each of 4 companies of 4 subdivisions. A company of non-combatants, comprising clerks, sick attendants, artificers, and drivers, is formed separately for each regiment. The strength per regiment is in peace, 1,755; in war, 3,640 combatants. On mobilization each forms a reserve or *dépôt* battalion for its own completion when in the field. Two regiments form a brigade; two brigades a division, of which there are 3 Guard, 4 Grenadier, and 41 Line.

2. *Reserve Infantry (Cadre) Battalions.*—1 Guard, 96 Line, 6 Caucasus, and 7 Siberia. These battalions are of 5 companies and 471 or more combatants. In peace they are employed almost exclusively in garrisons and for duties in the interior; in war they are utilized as garrison troops, and also to strengthen the field army. Each company is expanded on mobilization into a battalion of war strength, and each battalion into a regiment of 5 battalions. These then form 1 Guard and 96 Line reserve regiments in European Russia, 6 reserve regiments in the Caucasus, and 7 in Siberia, 1 of which has only 2 battalions. The 5th battalion of each regiment is formed independently, and employed as a *dépôt* and for duties in the interior, except in the case of the reserve regiments allotted to garrisons. These 5th battalions may, however, be subsequently replaced by the Reichswehr, formed into regiments and sent into the field.

Like the active regiments, those of the reserve in European Russia are formed into divisions, 4 per division, and these are numbered from 42 to 65, following the active Line divisions. Of these reserve divisions, 12 (the 1st category) are furnished with complete train, with a view to their reinforcing the field army; the remaining 12 (the 2nd category) are not so provided, as they are intended for garrison duties. The reserve troops are approaching nearer and nearer to the active troops, both in training and equipment; in 1886 nearly one-half of them were called out to join the camps of exercise, and the necessary camp equipage has been provided for the 1st category.

3. *Rifle Battalions.*—4 Guard, 20 Line, 8 Finnish, 4 Caucasian, 4 Turkestan, 8 Trans-Caspian, 8 East Siberian. They are each of 4 companies, with a strength in peace of 442, and in war of 913 combatants, and, with the exception of the 8 Finnish, are formed into brigades of 4 battalions, making 1 Guard, 4 Line, 1 Caucasian, 1 Turkestan, 2 Trans-Caspian, and 2 East Siberian brigades. In war the European brigades form each a *dépôt* battalion, and the Finnish battalions each a company.

4. *Other Infantry Formations.*—20 Turkestan line battalions, each of 4 companies, and 664 combatants, both in peace and war, formed into 4 brigades of varying strength.

8 West Siberian line battalions, each of 4 companies, and 664 combatants, both in peace and war. The 5 battalions stationed in the Semiretschensk territory are formed into a brigade.

5 East Siberian line battalions, each of 5 companies, and with a strength in peace of 556, and in war of 736 combatants; 2 Kuban-Plastun battalions of 4 sotnias, with 769 combatants in peace, which are expanded to 6 battalions of 748 combatants in war.

2 Transbaikal Cossack battalions, each of 5 sotnias, with a peace strength of 946 combatants; in war, 6 battalions of 920.

1 Amoor Cossack half-battalion	{	Each 1 sotnia of 160 combatants, to be raised in war to 2 half-battalions of 3 sotnias of 182 combatants.
1 Ussuri " "		

The Crim Tartar rifle company forms in war a battalion of 913 combatants. The Gurisch foot Drushine of 4 sotnias and 816 combatants in peace and war.

The Grusinisch foot Drushine of 4 sotnias and 266 combatants in peace, and 816 in war.

2 Batoum foot sotnias of 108 combatants in peace and war.

II. Cavalry.

1. *Guard and Line Regiments.*—10 Guard (4 Cuirassiers, 2 Dragoons, 2 Lancers, 2 Hussars), 48 Line, all dragoons. They have each 6 squadrons, and an establishment both in peace and war of 876 mounted combatants, except the Guard Cuirassier regiments, which have a strength in peace of 592, and in war of 601. The Guard regiments are formed with the two Body Guard regiments of Don Cossacks and squadron of Ural Cossacks into 2 Guard Cavalry divisions in peace, and into 3 in war. The Line regiments are formed into 14 cavalry divisions, in each of which there are 3 of these regiments and 1 Cossack regiment, and 1 Caucasus division of 4 Line regiments. Each cavalry regiment has a detachment which trains the remounts in peace, and forms a depôt in war, at which 2 squadrons of 185 combatants with horses are formed to complete the regiment in the field, and a dismounted formation of 135 combatants.

2. *Cossack Regiments.*—*Don Cossacks.*—1st category (serving in peace-time): Don Cossack and Ataman Body Guard regiments, each of 4 squadrons and 468 combatants in peace, and of 6 squadrons and 876 combatants in war. 15 Line regiments of 6 sotnias, in peace of 911, in war of 914 combatants; 1 regiment is kept in the Don territory; 4 form the 1st Don Cossack division; the remainder are incorporated in the regular Line cavalry divisions.

2nd category (dismissed to their homes during peace, with the obligation to maintain horse and equipment ready for service). The reserve regiment of the Don Body Guard, 876 combatants, supplying in war the Guard Cossack regiments; 15 Line regiments of Don Cossacks of 879 combatants; 30 independent sotnias of 150 combatants.

3rd category (dismissed to their homes in peace, with the obligation only of maintaining their equipment ready for service): 15 Line regiments of Don Cossacks of 879 combatants.

Kuban Cossacks.—1st category: Guard squadron, 193 combatants always; 2 squadrons Kuban Division, 282 combatants always; 10 Line regiments, in peace, 878; in war, 876 combatants.

2nd category: Guard squadron, 191 combatants; 10 Line regiments, in peace, 22; in war, 876 combatants.

3rd category: 10 Line regiments, in war, 876 combatants. Each Line regiment has 6 sotnias.

From the Kuban regiments are formed the 1st and 2nd Caucasus Cossack divisions, the Trans-Caspian Cossack brigade, and the Kuban Cossack brigade.

Terek Cossacks.—1st category: 1 Guard squadron of 191 combatants, 4 Line regiments, composed in peace of 604, in war of 586 combatants.

2nd category, as in 1st category, in war only.

3rd category: 4 Line regiments of 586 combatants in war.

With the exception of one, which forms part of the 1st Caucasus Division, the regiments of the 1st category form the Terek Cossack Brigade.

Astrachan Cossacks.—1st, 2nd, and 3rd categories: each 1 Line regiment of 4 sotnias; in peace 602, in war 585 combatants.

Orenburg Cossacks.—1st category: 30 sotnias formed into 6 Line regiments; 3 independent sotnias, in peace 147, in war 146 combatants each.

2nd and 3rd categories, each of 6 regiments.

In war the 18 regiments have 6 sotnias each, and a strength of 881 combatants; in peace the three first regiments of the 1st category have 6 sotnias, and an establishment of 889 combatants; the other three have only 4 sotnias.

Ural Cossacks.—1st category: 1 squadron of Body Guard, 189 combatants in peace, 157 in war, attached to the 1st Cavalry Division of the Guard.

Three Line regiments, the 1st with 6, the 2nd with 4, and the 3rd with 5 sotnias; 189 combatants in peace, and 157 in war per sotnia.

Siberian Cossacks.—1st, 2nd, and 3rd categories, each of 3 Line regiments with 6 sotnias; peace strength (1st category) 897, war 881 combatants.

Semiretschensk Cossacks.—1st, 2nd, and 3rd categories, each of 1 Line regiment with 4 sotnias; in peace 650 (1st category), in war 615 combatants.

Transbaikal Cossacks.—1st, 2nd, and 3rd categories, each of 1 Line regiment with 6 sotnias; in peace 1,021 (1st category), in war 910 combatants.

Amoor Cossacks.—1st, 2nd, and 3rd categories, each 2 sotnias with 335 combatants (1st category); in war the 6 sotnias form a regiment of 911 combatants.

3. *Other Field Formations*.—(a.) 1 sotnia in Irkutsk (138 combatants), and 1 in Krasnojorsk (94 combatants).

(b.) 2 Ussuri sotnias, each of 147 combatants.

(c.) The permanent militia formations:—

1 Daghestan irregular regiment of 6 sotnias with 777 combatants formed from volunteers.

1 Kuban sotnia of 87 combatants.

9 Terek sotnias, each of 115 combatants.

3 Daghestan sotnias, each of 186 combatants.

3 Kars " " 108 "

1 Batoum sotnia of 108 combatants.

1 Suchoum " 170 "

Turkoman Militia 314 "

(d.) The Crim Tartar Division of 2 squadrons, with 252 combatants in peace, forming in war a regiment with 876 combatants.

(e.) 6 Gendarmerie Cadres (1 Guard, 5 Line), each of 33 combatants, for police duties with the troops in peace, and forming in war 6 squadrons, each of 159 combatants.

III. Artillery.

1. *Field Artillery*.—3 Guard; 4 Grenadier; 41 Line; 1 East Siberian; 1 West Siberian; 1 Turkestan; 3 Mountain Brigades. The 48 brigades stationed in European Russia have each 6 batteries, of which the 1st and 2nd are heavy, the 3rd and 4th light; the 5th and 6th are in 42 brigades, light, and in the remaining 6, stationed in the Caucasus and the Crimea, mountain batteries. In the brigades in Asia, the East Siberian has 4 batteries, two light, two mountain; the West Siberian has 4 batteries, three light, one mountain; the Turkestan has 7 batteries, two heavy, three light, and two mountain.

In peace only 4 guns are maintained per battery, in war 8. The heavy batteries have 198 combatants in peace, 240 in war; the light 170 in peace, 208 in war; and the mountain 140 in peace, 236 in war. Two brigades and three batteries in Europe and the brigades in Asia have their full war complement of guns and wagons, or pack animals.

2. *Reserve and Depot Artillery*.—In peace there are 5 reserve field artillery brigades. Each has 6 batteries, one heavy, four light; and the 4th and 5th brigades have also mountain in addition to the light guns; the 6th battery have light and horse artillery guns. The 1st and 2nd batteries of the first

five brigades, and the 3rd batteries of the 2nd and 4th brigades have four guns. The whole of the 4th batteries, and the 3rd batteries of the 1st, 3rd, and 5th brigades have only two guns. The 5th batteries of the 4th and 5th brigades have also 2 mountain guns, and 2 pack horses. The whole of the 6th batteries have 2 light and 2 horse artillery guns.

In war 20 reserve brigades are formed from the first four batteries of brigades, each of 4 batteries with 8 guns—one heavy and three light. These 80 batteries are formed by means of reserve men, each of the four first peace batteries being expanded into a brigade of 32 guns.

The 5th and 6th batteries of the peace brigades are expanded in war into 5 dépôt brigades of 8 batteries, each peace battery forming 4 dépôt batteries. Of the 40 dépôt batteries thus formed, 37 are light, and 3 mountain. Each battery has 4 guns horsed and 4 pot; the 8th batteries have besides 2 horse artillery guns, to enable them to supply the wants of that branch in the field by means of trained drafts. The strength of every battery, besides the permanent portion for training purposes, which consists of 100 combatants, is primarily 500 combatants, but varies according as drafts are sent into the field.

In addition to the above there are 2 independent dépôt batteries, one of 2 light guns, the other of 2 light and 2 horse artillery guns. These form in war 8 batteries—the first seven of 4 light guns, the 8th of 4 light and 2 horse artillery guns. These are altogether separate from the 40 dépôt batteries stationed in the interior, and are distributed in rear of the operating army with a view to supplying the immediate requirements of the artillery in gunners, drivers, and horses.

3. *Sortie Batteries*.—In each of the five fortresses of Warsaw, Novogorogievsk, Brest-Litovsk, Ivangorod, and Kovno, one sortie battery, with 2 guns and 123 combatants, is maintained in time of peace. In war these 5 batteries form 16, with 8 guns and 128 combatants, which are allotted to the fortresses which receive war garrisons.

4. *Horse Artillery*.—1 Guard brigade and 23 Line batteries; 1 Turkestan and 1 West Siberian mountain battery. The Guard brigade has 5 batteries, and these with the 23 Line batteries have 6 guns in peace and war; 169 combatants in peace, and 181 in war. The Turkestan mountain battery has also 6 guns, with 138 combatants in peace, and 142 in war. The West Siberian mountain battery has only 2 guns and 46 combatants in peace; but has 8 guns and 149 combatants in war.

5. *Cossack Batteries*.—1st category: 1 Don Cossack battery of the Guard and 7 batteries of the Line formed into a brigade. The Guard battery has 169 combatants in peace, 212 in war; the Line batteries have 184 in peace and 182 in war.

2 Terek Cossack batteries, 135 in peace, 206 in war.

3 Orenburg Cossack batteries, 187 in peace, 182 in war.

2 Transbaikal Cossack batteries, 135 in peace, 206 in war.

The Don and Orenburg batteries have 6 guns in peace and war; the others have 4 in peace and 6 in war.

In war the following new formations are created:—

Don Cossacks, 2nd category: 7 batteries and 1 horse artillery dépôt battery, 93 combatants.

3rd category: 7 batteries, 182 combatants.

Orenburg Cossacks: 3 batteries, 182 combatants, and 1 horse artillery dépôt battery, 47 combatants.

Transbaikal Cossacks: 1 battery, 206 combatants.

The regular Line batteries and a portion of the Cossack batteries are attached to the 18 cavalry divisions in peace time at the rate of 2 batteries per division, except the two Caucasus Cossack divisions, which have 1 battery

only. The cavalry of the Guard are only formed into divisions, three in number, in war, when 2 Guard horse artillery batteries are attached to each.

5. *Garrison Artillery* (reorganized in 1886).—50 Garrison Artillery battalions of 4 companies, with the exception of two, at Sebastopol and Ochakov respectively, which have 5 companies. The establishment in peace is 457 combatants, and in war 1,321. The fortresses of European Russia have allotted to them 44 battalions; the remaining 6 are apportioned to the fortified places in the Caucasus.

There are further 6 independent companies, varying from 170 to 451 combatants, one in St. Petersburg, the rest in Asiatic Russia.

IV. Engineers.

1. *Sappers*.—1 Guard, 1 Grenadier, 13 Line, and 2 Caucasus battalions, having in peace a strength of 5 companies with 594 combatants, and in war of 4 companies with 912 combatants. The 68 companies are in war allotted to the 60 infantry divisions. The 5th companies on mobilization form each 2 companies, making 34 companies, of which 16 with 224 combatants are destined for duties on the line of communications and for siege works. The remaining 18 companies take over the duties in the home fortresses. Four depôt battalions are formed with a permanent establishment of 179 combatants, and a further strength of 1,100 combatants from which drafts are furnished to the formations in the field.

2. *Pontoniers*.—8 battalions, each of 2 companies, with a strength in peace of 241 combatants, and in war of 512. Each battalion carries with it materials for a pontoon bridge of from 215 to 311 metres, and a trestle bridge of 47 metres.

3. *Railway Troops*.—6 battalions, of which the 1st has in peace 97 combatants, in war 1,026; the 2nd, 3rd, and 4th in peace 576, in war 1,026; the other two are Trans-Caspian battalions, and have 1,026 combatants both in peace and war. Each battalion has 4 companies, 2 for construction, and 2 for working the line. All excepting the two battalions have further a cadre company of 93 combatants, and from these 4 companies a Reserve battalion of 1,026 combatants is formed.

4. *Engineer Field Park*.—6 parks, with a strength in peace of 18, in war of 89 combatants. In peace the material is maintained and a small detachment to look after it. In war the park is divided into two divisions, each of 5 sections. Each section is arranged to supply 1 infantry division and 1 sapper company.

5. *Military Telegraph Parks*.—17 parks, with a strength in peace of 56, and in war of 208 combatants. Each park is divided into 2 divisions, each of 2 stations, and provides for communication over 69 kilos. It is also furnished with 960 metres of cable for a submerged line.

6. *Torpedo Troops*.—4 companies in peace of 244 combatants, in war of 247; for the defence by mines of Cronstadt, Sweaborg, Odessa, and St. Petersburg. They are organized in 2 divisions, each of 2 companies, in the Baltic and Black Sea respectively. There is further a company which forms a training school in electricity of 157 combatants in peace, and 248 in war.

There are further the local troops for service in the interior and the various schools and training establishments.

Small-arm Ammunition.—The following table gives the amount of ammunition per rifle to be carried in the field, and shows how it is carried:—

	In the pouches and pack.	In the S.A.A. carts or wagons.	In the flying artillery parks.	In the movable artillery parks.	In the local parks.	Total.
Troops with the 48 in- fantry divisions—					According to the orders issued specially.	
Infantry and rifles .	84	48 ¹	59	12½		203½
Engineers.....	40	10	—	—		50
Cavalry.....	36	36	55	11½		138½
With the 12 reserve divi- sions—						
1st Category in- fantry.....	84	48	—	48½		180½
With the 8 reserve divi- sions—						
2nd Category in- fantry.....	84	48	—	24½		156½

Supplies to be Carried in the Field.—The proportion, in days, of the rations of food and forage to be carried by the men or horses themselves, and by the several kinds of transport, is given in the following table :—

	Iron rations.	Regi- mental train.	Divi- sional train.	Army train.	Total.
Per man of dismounted troops ...	2½	1½	4	8	16
" the engineers.....	2½	5½	—	8	16
" the field batteries...	3	1	4	8	16
" the mounted troops ..	2	2½	4	8	16½
Per riding-horse {	corn 2 hay 1	—	—	4	6
Per draught horse..... {	— {				
		corn 3 hay 2	—	4	7

War Strength of an Infantry Division.—2 brigades each of 2 regiments of 4 battalions, total 16 battalions : 326 Officers, 1,318 non-commissioned officers, 12,938 combatants. 6 batteries of 8 guns; in the reserve divisions 4 batteries only.

War Strength of the Cavalry Division.—3 Dragoon and 1 Cossack regiment, total 4 regiments : 143 Officers, 304 non-commissioned officers, 3,082 combatants. 2 horse artillery batteries of 6 guns.

War Strength of an Army Corps.—A corps consists generally of 2 or sometimes 3 infantry divisions and 1 cavalry division. The combatants of a corps are as follows :—

¹ 1st echelon, 12; 2nd echelon, 36.

First, when of 2 infantry divisions—

Corps staff.....	29 Officers	5 non-com. officers	32 men
32 battalions, including staffs	652 "	2,636 "	25,876 "
4 regiments of cavalry....	143 "	304 "	3,082 "
12 field batteries with 96 guns.			
2 horse artillery batteries with 12 guns.			

Second, when of 3 infantry divisions—

Corps staff.....	29 Officers	5 non-com. officers	32 men
48 battalions, including staffs	978 "	3,954 "	38,814 "
4 regiments of cavalry....	143 "	304 "	3,082 "
18 field batteries with 144 guns.			
2 horse artillery batteries with 12 guns.			

Special Training.—The attention that has been paid in Russia since the Turkish War to the training of the troops for war has not been allowed to slacken. In 1886, besides the careful training of the infantry in musketry, the exercising of the cavalry in distance rides, and of the artillery in gun practice from massed batteries, which were only a continuation of what had been initiated in former years, the training was further developed in some special directions. The attack by a force of all arms, using service ammunition, of positions marked by targets, had in previous years been conducted experimentally; and the result of these experiments was regarded as so satisfactory that these exercises were ordered to be carried out last year in every command.

With a view to ensuring the presence in each company and troop of a certain number of selected men skilled in leading patrols, and specially qualified for any dangerous enterprise, regular detachments have been formed in every regiment. They are trained partly by means of constant practice in field sports and partly by feats of endurance such as are likely to be required in war. Their number is limited to four per company, squadron, sotnia, or battery, only powerful, active men being chosen; those of the infantry must further be good marksmen, and the cavalry men good riders. The number per infantry regiment may be 64 men, and the nature of the sport in their case is shooting big game; to defray the expense of guns and equipment a sum of 500 roubles is allowed. The animals killed are sold for the benefit of the detachment. In the cavalry the Government grant goes to keep up a pack of hounds, which the men ride to. Access is allowed to all Government lands; but only over private property when the permission of the proprietor can be obtained. The men are also trained in leading parties, equipped as for war, long distances, through broken and difficult ground. They are not exempted from their ordinary duties with their regiments, so the hunting has to be restricted to the times when they are not required in the ranks.

Servia.

A new Army Law was introduced towards the end of 1886, replacing that of 1883. The principle of general personal service remains unaltered, and the duration of the obligatory service is divided into three periods or levies.

First levy from the age of 20 to 28.	
Second "	28 ", 37.
Third "	37 ", 50.

The period with the colours is, as before, two years. The cadres are to be

maintained for the 2nd levy, to which the yearly classes are to be called up for short trainings.

Organization.—The 1st and 2nd levies have similar formations. On mobilization they furnish the following force :—

- 15 infantry regiments of 3 battalions.
- 5 cavalry regiments of 5 squadrons.
- 5 artillery regiments of 4 batteries.
- 1 regiment of mountain artillery of 5 batteries.
- 1 pioneer regiment of 5 battalions.
- 1 pontoon
- 1 regiment of siege artillery.
- 1 railway regiment.

Together with the necessary sanitary, transport, and administrative services.

The field army should consist, therefore, of the following combatant formations :—

- 90 battalions.
- 50 squadrons.
- 40 field batteries.
- 10 mountain batteries.

The administrative and supply services have by the new law been provided for on an adequate scale, and the increase made in the personnel, combined with the establishment of depôts, promises to render them thoroughly efficient.

Turkey.

A new recruiting law was promulgated in October, 1886, which came into force in March last, the principal provisions of which and their influence on the military organization are as follows :—

1. Every Mussulman is liable to serve between the ages of 20 and 40, with the exception of the inhabitants of Constantinople, Crete, and the islands of the Archipelago.

2. Those liable for service are divided into two classes, of which the first (Muinlis) are allotted to the regiments of the active army, with which they serve six years. As the annual class is in excess of the contingent required to keep the army up to its peace establishment, the supernumeraries taken from those drawing the highest numbers are only temporarily embodied for instruction, during a period of from five to nine months. The second class (Mounsiz) are not embodied, being composed of those men who for various reasons defined by the law, can less readily be spared from their homes. These are drilled once a week, at or in the vicinity of their homes, by the Officers of the Redif, or Landwehr, and with a view to facilitating the conduct of this training, a scheme has been framed for readjusting the Redif districts by breaking up the battalion districts now existing into 4 company, and these again into 4 section districts. In order to obtain the Officers required for the purposes of instruction, a corps of reserve Officers is to be formed from selected non-commissioned officers and men.

3. The periods of liability in the several categories are as follows :—

In the active army (Muassaf)	6 years.
In the reserve and Landwehr (Redif)	8 "
In the Landsturm (Mustafiz)	6 "
Or until the age of 40.	

Small cadres are maintained in peace, both for the Redif and the Mustafiz.

Land and Sea Defences.—As a result of the Bucharest peace, Turkey has taken over herself the administration of the frontier territory of Kirdjali and

Rhodope, which gives her the command of the whole of the Rhodope Balkans, the passes of which she has fortified by means of forts and entrenchments. The fortifications on either side of the Dardanelles have been brought more into accord with modern requirements, and into harmony with each other. Especially a mortar battery has been constructed on the heights of Teke for the support of Fort Namzieh, which is situated on the European side, at the narrowest point of the Straits, and is the strongest work in the whole line of defence. For the shore batteries, 60 mortars of 21, 15, and 12 cms. have been purchased from Krupp, and also 34 coast defence guns of 24 and 35.5 cms. Provision has also been made for the preparation of mines, and for telegraphic communication between the several works.

For the protection of Constantinople from the west and north-west, the lines of Tschataldja, between the Black Sea and the Sea of Marmora, which were partially destroyed by the Russians during their occupation of them in 1878, have been again placed in a state of defence.

In Asia Minor the defences of the port of Smyrna and of Van, Mush, and Erzeroum have been improved, and the latter place armed with Krupp guns.

At Erzincan, where the staff and one division of the IVth Army Corps are stationed, an entrenched camp has been established.

Infantry Tactics.—The year 1886 will be remembered as marking the definite acceptance of the principle, that the magazine rifle is the arm of the future. In the armies of Germany and Austria the experiments made were brought to a conclusion in favour of such arms, the introduction of which was proceeded with before the close of the year. In other States, as France and Italy, experiment led before the end of the year to a decision as to the pattern of arm to be adopted, but except for experimental purposes, no issues were made before the beginning of 1887. Those States which did not during 1886 decide upon the actual arm to be introduced, accepted nevertheless the principle of the magazine, and only delayed coming to a decision as to pattern, so that they might profit by the development of the system, and obtain the most perfect arm available. There can be no question but that the introduction of the new arm will lead to modifications in the tactics of infantry; but at the present time, except in France, where a special *formation de combat* was issued to the Army during General Boulanger's administration, the regulations have not been altered in this sense.

The most important regulations published in Germany during 1886—*Entwurf einer Felddienstordnung*—relate to the duties of the troops in the field and their training for these duties, replacing the regulations previously in force, which dated from 1870, and had ceased to be applicable in many particulars. It is divided into two parts, of which the first relates to the field duties, and the second to the training for them. The following are some of the more important alterations in the former. It is laid down as an order, what already existed as a custom, that the bearer of an order must, on receiving it, and before riding off, repeat it to the sender. Mounted cavalry are to be attached to all commanders of the higher units, in number as required for army corps and divisions, 2 for each brigade and infantry regiment, to be taken from the divisional cavalry regiment. On the march the "point" of the advanced guard, the regulated strength of which has hitherto been 4 men, is in future to consist in the cavalry of 1 Officer, 1 non-commissioned officer, and 4 to 6 men, and in the infantry of 1 Officer and a section. The utmost latitude is allowed in the constitution and placing of outposts, and the distinction between these when placed in front of a rigid line, as in the investment of a fortress, and when posted by a body of troops in the open field, is dwelt upon. In the former case a connected chain of observation must be established, to watch every change and movement in front of the

enemy's lines. In the latter case a rigid chain is out of place; the security of the troops is best secured by ascertaining the enemy's movements at a distance from them, and posts of observation are generally only required on the actual lines of approach. The outpost companies secure themselves by picquets or non-commissioned officers' posts, or both. The picquets are not in future to be numbered, but will be distinguished by the name of their Commanders or the locality. To each outpost company ten mounted orderlies are attached, who are intended for patrolling duties, especially at night, as well as for carrying reports. These companies, as well as the picquets' and non-commissioned officers' posts, should, where circumstances admit of it, be brought under cover, knapsacks taken off, and helmets removed; but care must be taken that exit is easy. The parole and countersign has been abolished, as the system was found to lead to frequent and lamentable mistakes; every party or person approaching is to be halted, and only allowed to pass if they are recognized as belonging to the troops. The use of dogs, which may be with the troops, is allowed with picquets and posts, and small patrols under an Officer advocated for obtaining information regarding the enemy.

With cavalry outposts the main body of the squadron may be placed under cover; but this is forbidden in the case of the picquets. The employment of dismounted posts of from four to twelve men, under a non-commissioned officer, is enjoined in situations where their fire may be employed to advantage, as in the defence of a pass or a barricade.

In France new regulations and instructions in field duties were issued, but the principal interest was devoted to discussions on the question of the pattern of magazine rifle to be adopted. The school of musketry at Châlons was reorganized on the German plan, and three regional schools established for the training of instructors of the rank of Lieutenant, sergeant, and corporal. At the Châlons school captains will be trained, specially with a view to extending the knowledge of the principles of musketry amongst the Officers of that rank.

In Russia, although the decision in regard to a new rifle was postponed, the greatest pains continued to be taken with the musketry training of the troops, and every endeavour made to practise them in field firing, the conditions of which should be assimilated as closely as possible to the operations of actual warfare. Having this in view an extension was, as has already been stated, given to the exercises of the combined arms, and it was ordered that these should be practised for the next three years throughout the Army. The strength of the mixed detachments to be formed for this purpose is 1 battalion at a war strength, 1 field battery of 8 guns, 1 horse artillery battery, and 1 to 2 squadrons of cavalry, having 2 ammunition wagons per battalion, and 1 per squadron. A tactical idea is to be given in each case, which will lead to the working of the three arms in combination. The march to the ground to be operated over is to be conducted with all the precautionary measures required in an enemy's country, and the scheme is only to be imparted to the commander when approaching the ground. Infantry fire at formed bodies is to be executed at from 600 to 800 paces, its duration being from two to five minutes; against cavalry charging, it is continued for one minute only. One half of the ammunition allotted to the exercise is retained in the wagons, and issued during its course in the same manner as if in the field.

Revised regulations were issued in 1886 for the supply of ammunition in the field. An infantry regiment carries, exclusive of the ammunition in the men's pouches, 153,504 rounds, being 48 per man; it is carried in 533 zinc cases, by 33 one-horsed carts. Of these, 16 are attached to companies, and the remaining 17 form the general regimental reserve. Of the 16 company carts, 8 form the 1st group, and follow immediately on the troops; 8 follow

the marching column, forming the 2nd group; in rear of all follows the general reserve. Upon forming up in rendezvous formation from column of march, the 8 carts of the 1st group form twenty paces in rear of the regiment or battalion, in 1 or 2 lines. On assuming the fighting formation they are placed according to circumstances behind the 1st or 2nd line, taking advantage of any cover available. In attacking, the carts must, if necessary, be brought up into the firing line; in other operations, or if the ammunition cannot be supplied direct from the carts, the reserve companies complete the ammunition of the firing line from that in their pouches, and fill up from the carts.

When the supply of the firing line is carried out direct from the carts, two or three of these are brought up close in rear of the troops requiring ammunition; 1 non-commissioned officer and 6 to 10 men are told off from each company to carry up the ammunition, either in the cases or in canvas bags, who remain with the firing line after bringing it up.

An important alteration has been made by the mounting of all company commanders. The change has already been given effect to in the Guard and the 1st Army Corps.

Cavalry Tactics.—In the year 1886 a revised cavalry drill book was issued in Germany, and also instructions for the training and conduct of cavalry in field duties. It is worthy of notice that in the latter the duties connected with obtaining information regarding the enemy, and those to be taken for the immediate security of the troops, are kept entirely distinct. As regards the former a distinction is drawn between these duties in their wider sense, as conducted by the cavalry divisions, and combined with the destruction of railways, telegraphs, and magazines, and in their narrower sense when carried out by the divisional cavalry.

The proportion of the several arms to form the advanced guard is fixed at from one-sixth to one-third of the infantry and the artillery with all the cavalry. The disposition of a division on the march is—1st, an Officer's patrol; 2nd, advanced guard cavalry, advance, 1 squadron, support, 2 squadrons; 3rd, advance, 1 battalion, 1 subdivision of the staff squadron, 1 battalion; 4th, support, 2 battalions, 2 batteries, 1 subdivision staff squadron; 5th, main body, 9 battalions, 3 batteries, 1 subdivision cavalry; 6th, heavy baggage, escorted by 1 subdivision staff squadron.

In the outpost duties the cavalry is made quite independent of the infantry, and the duties divided between them. During the day the cavalry is sent well forward, while the infantry rests and cooks; at night the cavalry as a body is called in, and the necessary measures for the security of the troops fall to the infantry, to which are attached sufficient cavalry only for orderly and patrol duties. The number of mounted men to be attached to the main body of the outposts for these purposes is from 4 to 6, and to each company 10, of which 1 or 2 are detached with each picquet.

The leading principle in the conduct of outposts is indicated to be constant patrolling well out; the chain of posts is regarded as quite a secondary matter. The cavalry outposts are divided into squadrons, pushed forward in front of the centre of the infantry, and the cavalry picquets and non-commissioned officers' posts detached from these to the front and flanks. These posts are from four to twelve horses strong, and are generally all dismounted, which saves much wear and tear of equipment; one man is pushed forward on foot in observation. The vedettes are relieved every hour, only one man need remain mounted. Every road should be occupied by a non-commissioned officer's post, serving as examining party; the special examining party formerly prescribed is done away with.

The distribution of the cavalry with an infantry division halted would be the following:—1st. The main body of the division in cantonments; the

infantry and 2 subdivisions of the staff squadron. 2nd. Advanced guard, 3 battalions, 3½ squadrons (2 subdivisions, Staff squadron), 1 battery, distributed as follows :—Support, 1 battalion, 1 squadron, 1 battery ; outposts, main body, 1 battalion, 1 subdivision, staff squadron ; advanced companies with their mounted orderlies ; cavalry, 2 squadrons with their picquets and non-commissioned officers' posts furnishing vedettes and patrols. At night the cavalry join the support.

In Russia no efforts have been spared to increase the mobility and independence of the cavalry. The general expectation that, with the conversion in 1882 of the hussars and lancers into dragoons, the Russian cavalry would resolve itself into mounted infantry has not been fulfilled. The special characteristics of cavalry have been jealously retained, and it is expressly laid down that its primary rôle is that of cavalry, though it is intended and trained to act dismounted on occasion. The object in view when the conversion was effected was to form of the cavalry a large and uniformly equipped body, that should be able to move promptly and independently across the frontier in the event of war, and by its action delay in every possible way the concentration of the enemy's troops. This object has been kept constantly in view since, and all the special training of the cavalry has been with the intention of preparing it for that rôle. The training has taken the form of distance rides and swimming exercises, both of which have received an increased development from year to year. The rides are now carried out in almost every regiment ; they commence with individual Officers, or small detachments of selected men and horses, and are subsequently practised by squadrons, and even regiments. The results have been most satisfactory, and besides the actual training of man and horse, the experiences gained in regard to many important points, such as pace, foraging and watering, halts, equipment, shoeing, &c., have been most valuable.

The swimming exercises have not yet been made so general ; but in a country such as Russia, intersected with rivers having but few bridges, the value of such exercises is evident, and is fully recognized. They are further calculated to develop the individual pluck and handiness of the men. In the spring of this year two sotnias of the 5th Orenburg Cossacks swam the Syr Darya, at a point where it was 1,200 feet broad, in a quarter of an hour. The clothing, arms, and saddlery was carried across on boats, and ten minutes after landing the sotnias were ready to march. It has been found better to allow a somewhat longer halt before marching, for the horses get very excited, and require about twenty minutes to quiet down.

A further extension has been given to the training of selected Officers and men in engineering duties. Each year detachments are sent from each regiment for this purpose to the several engineering camps, where they are instructed in the construction of rough bridges from unprepared materials, and in hasty defences.

Field Artillery Tactics.—There is nothing to be noticed in regard to the employment of artillery in the field as compared with former years, nor has the literature on the subject brought forward any new views. A good deal has, however, been written regarding the employment of horse artillery acting in connection with cavalry. An article in No. 61 of the Military "Wocheblatt" treats of the subject as follows :—The number of horse batteries which should be allotted to a cavalry division of 3 brigades, each of 2 regiments, is still an open question. Three batteries appears a somewhat high figure ; but looking to the distribution of the Division in 3 brigades, they are necessary. To make this clear the question should be answered : when does the cavalry particularly require support of the artillery ? is it at the moment of the attack ? The reply must certainly be in the negative. The artillery plays at this moment only a subordinate rôle ; it is only on

rare occasions that its action can then be decisive, for the decision must depend upon the strength and manner of handling of the opposing masses. For the purpose of co-operation in the attack one battery per division would amply suffice. The distribution of the horse artillery with the cavalry division is made on other grounds. It is based upon the duties to be performed by the cavalry in front of the army or in rear of an investing force. Here the artillery does not play a subordinate part, but one that requires a battery to be with each brigade, and to remain with it so long as the action of the cavalry does not develop into a conflict with the mass of the enemy's cavalry. In such a case it is for the commander of the Division to decide what batteries shall take immediate part in the action. These batteries must bring an effective fire to bear on the enemy's cavalry and draw the fire off their guns. The commander of the artillery must act promptly on his own initiative, and bring his guns to bear at a range of from 1,200 to 1,500 metres. Shrapnel must not be employed too early. During the actual attack the artillery must continue their fire or remain unlimbered and prepared to meet any sudden attack.

The subject of the employment of horse artillery with the cavalry division is also considered in the French "Revue d'Artillerie." The principal rôle of the Division is to observe the enemy's movements, while covering from view those of the troops of which it forms a part. Conflict with the enemy's cavalry is not the object in view, though it may be a means to the end. The artillery only takes part in the action of the cavalry when it becomes necessary to engage the enemy's cavalry. When two bodies of cavalry are in face of one another, their engagement ensues only from the commander of the one or the other electing to force a fight. The attack will then follow quickly upon this decision, and the *mêlée* will follow immediately upon the attack. What an influence then will the artillery have, not only upon the result of the engagement, but upon the decision of the commander to take the initiative! The artillery exercises not only a physical, but also a powerful moral influence, which is calculated to raise the *élan* and the enthusiasm of the cavalry. It can lead to an engagement, and can hasten or obviate it, according to the moment when it opens fire, for the sound of the guns will greatly affect the decision of the leaders. By its moral influence the fire of the artillery will be the signal for attack; after the first gun there can be no longer any question of surprise. The greatest responsibility therefore rests upon the commander of the artillery; he must be given the most precise instructions regarding his action, lest he should open fire either too early or too late. It will be too early if the cavalry have not at the time completed the arrangements for the attack; it will have the further effect of rendering surprise impracticable, and of warning the enemy to complete their dispositions. Co-operation in the action of the two arms is for this reason absolutely necessary.

In the actual engagement, the artillery can only be of use so long as its fire can be maintained, and its disposition must be ruled by this consideration. The fire must be opened unexpectedly, so as to surprise the enemy, and should from the first be briskly conducted; for it must be borne in mind that from the nature of the case it cannot be continued for long. It will begin with the movement to attack of the cavalry at about 2,500 metres, and be continued until the *mêlée* ensues, which will be when the two opposing cavalries have each moved half way, or about 1,250 metres, which will not occupy more than about 5 minutes. This brief period will be best utilized by the guns of batteries firing together, which they will be enabled to do about twelve times. The projectile to be used will be the percussion shell, and the enemy's cavalry will be the object, for the aim is above all things to break the force of the charge. Each battery should apply its fire to a separate portion of the

enemy's force. Shortly before the actual *mêlée* the fire will be diverted from the first line and directed upon the reserves. The artillery has little to fear from the attack of cavalry, and even if they should force their way into a battery they cannot do much harm.

During the advance the three batteries should be kept as near as possible to the head of the main body, in order of march. So soon as the cavalry leader decides upon making an attack, the artillery will be sent forward as far as the advanced squadrons, and the commanders of the cavalry and the artillery will together reconnoitre in front. If the enemy should be at a distance of from 3,000 to 4,000 metres, the batteries will be ordered to take up their positions, and the cavalry to assume its formation for attack. The cavalry leader will point out to the commander of the artillery the general position to be taken up by the guns, and the ground over which it appears probable the attack will be made. The artillery commander, after examining the ground carefully, selects the positions for his batteries, into which they will be ordered up from the preparatory positions, where they will be waiting in readiness to move. Fire will only be opened on the special order of the commander, to be given as soon as the cavalry commences its movement for the attack. When the *mêlée* commences, he will send forward to close quarters a battery to fire blank, an expedient the moral effect of which may be of value, or to direct its fire on the enemy's reserves. In the event of the attack failing, a second battery may be detached to cover with the first the retirement of the cavalry.

If the cavalry commander should be surprised and wish to avoid the engagement, the artillery will be placed in a favourable position for covering the retreat, and will open fire when the enemy moves forward to attack. If, on the other hand, the commander, although surprised, wishes to accept the engagement, there will be no time for special preparations, and it will be the more necessary for the artillery commander to act with promptitude and decision; he must attempt, at all hazards—even to the sacrifice of his artillery—to break the force of the enemy's attack.

In the October number of the "*Journal des Sciences Militaires*," the writer of an article on the same subject criticizes the French regulations for the conduct of the artillery with a cavalry Division, and after doing so—with some reason—he puts forward his own views on the question. These are briefly as follows:—Upon the cavalry assuming the formation for attack, one battery should be disposed on either flank of the first line; the third to be retained in rear of the centre. The two former batteries open fire as soon as they can see the mass of the enemy's cavalry. During the further advance of the line, they follow it in echelon of half batteries. As soon as the divisional commander has recognized the ground where the collision will take place, he orders the third battery to take up a position commanding it, and fire at long range upon any portion of the enemy in view without intermission. In case of the attack being successful this battery will be moved forward, and if unsuccessful it will cover the retreat.

Having the foregoing views before us, it is interesting to note that the German regulations on the subject of the handling of the horse artillery carefully avoid laying down definite detailed rules, preferring to leave ample scope for the judgment and discretion of the commander on the spot. Certain general rules are given, such as that fire should be opened early, and in the first line against the enemy's cavalry; that no changes of position should take place during the course of the engagement, and no decisive action is claimed for the arm. The French regulations of 1882, on the contrary, contain detailed and restrictive instructions, late opening of fire, manœuvring during the engagement, and finally they attribute a very important rôle to the artillery, being in each of these particulars exactly the reverse of the German regulations.

Selection of Artillery Positions.—The question was discussed in No. 54 of the Military "Wochenblatt." Shortly stated, it was claimed that the selection of a position is one of the most important duties of an artillery commander, demanding for its proper fulfilment a good eye for country, circumspection, experience, and prompt decision. The German regulations lay down that the consideration of ensuring an effective fire must always come before that of obtaining shelter from the enemy's fire. The question follows, what circumstances favour or affect the efficiency of the fire? The answer is, briefly, that from the position of the guns the objective must be sufficiently clearly seen to allow of proper aim being taken and of the range being corrected by seeing where the projectiles strike. In selecting a position the commander must be quite clear as to the objective, when a glance will suffice to decide whether the position is suitable. The next point is as to cover, which must be obtained in some way or other, for otherwise, under the increased intensity and effect of fire, the guns could not long remain efficient. The chief thing is to impede the enemy's view by means of a mask, such as may be found in hedges, banks, &c., but looking to the power of shrapnel, the guns must be placed some way behind it. For this reason a position on the reverse slope of, and immediately behind, a ridge is not a good one. The same subject is treated of in the September number (1886) of the Italian "Rivista di Artiglieria e Genie," much the same conclusions being arrived at.

The Direction of the Fire of Large Masses of Artillery; its Difficulties, and the Means of Overcoming them.—This important subject is dealt with in the August number (1886) of the "Archiv für die Artillerie- und Ingenieur-Officiere, u.s.w." Victory on the battle-field depends upon being the stronger at the decisive point. It is not sufficient simply to have a preponderance in numbers on the field; this must be the case at one particular point, and the principle must be the basis of modern artillery tactics.

The efficient direction of the fire of large masses of artillery offers many great difficulties, of which the first is to be found in the distribution of the command and imparting of orders.

In order to secure the effect upon one particular point, it is necessary that the whole of the batteries shall direct their fire upon it simultaneously. The combination of the batteries of one Division (three batteries) is the starting point for the considerations that follow. From this combination special difficulties arise in regard to the view, the aiming, and the passing of orders. It is one of the most difficult tasks of the artillery commander to minimize these by appropriate arrangements regarding the communication of orders, the position of the batteries, and the conduct of the fire. The din of battle and the great extent of the position prevent the use of verbal commands or signals by the commander, whose orders must be given and correctly communicated.

In the position of a Division care must be taken to leave between the several batteries small spaces of the extent of from two to three gun portions, in which the battery commanders take their places. In the case of a side wind, the batteries to leeward are somewhat advanced so as not to be incommoded by the smoke of those to windward of them.

In principle batteries confine their attention to the objects in their immediate front. After the range has been verified several batteries may be directed to concentrate their fire on one object, in which case the corrected range will be communicated to their commanders. If the enemy has fewer batteries it is advisable not at first to bring a greater number into action—those selected to engage the enemy being the ones on the flanks of the line. The Division commander only exceptionally takes the direction of the firing out of the hands of the battery commanders. He distributes the batteries to the objects in their front, and superintends generally the proof of the

range by the batteries, having for its object the point on which the fire is eventually to be concentrated.

The difficulty as to aiming must from the first be minimized by the selection of objects in the line of fire. The most disturbing element in the firing are the enemy's projectiles. All the requisite arrangements can only be continued so long as the guns are not under fire. At distances of over 2,000 metres the positions of artillery are seldom recognized until it opens fire; this should, therefore, not be done too early. The Division commander should have completed his arrangements; and the battery commanders have reconnoitered the position and made their observations before the batteries are moved up to it.

The writer, Major Rohne, maintains that in the last war little experience was gained as to the regular direction of large masses of artillery, and that peace manoeuvres are useless for the purpose; he advocates the adoption of training in this respect on the artillery practice ground. His views have been criticized as dealing really only with Divisions of artillery, not with large masses, such as the regiment or brigade; and apart from this, the details of the procedure to be followed with the Division have met with opposition.

In a pamphlet, entitled "*Die Feld Artillerie der Zukunft*," published at the end of 1886, a scheme for the reorganization of the field artillery was proposed. By it the whole of the artillery of an army corps would be attached to the infantry Divisions, a regiment of artillery per Division; consequently the corps artillery would be done away with. Each regiment would be divided into three Divisions of three batteries. These regiments to be attached to the infantry Divisions in peace-time, and the necessary artillery Staff maintained. In war the ammunition columns to be attached directly to the regiments. Only so many horse artillery batteries to be maintained as are required for the cavalry Divisions, and these to be formed independently of the other artillery. The horse artillery batteries remaining, after provision has been made for the cavalry Divisions, to be converted into field batteries.

Tactics of Fortress Warfare.—The country that has shown the greatest interest and activity in regard to this question is France. The writer of the book, "*Vor der Schlacht*," that made some sensation, while taking a favourable view of the French establishments generally, condemns the connected and complete system of fortifications constructed for the defence of the eastern frontier, as impeding the strategical initiative on the part of the field army, and as being calculated even to affect the offensive spirit of the troops themselves. If his figures may be accepted as correct, the force that could be concentrated on the frontier on the second day of mobilization would amount to two army corps and six cavalry Divisions, which would be increased by the morning of the 8th day to 200 battalions, 250 squadrons, and 950 guns. Lieutenant-Colonel Heyde, in his study "*Landesbefestigung*" (1886), points out with conciseness the difference between the French and German systems of fortification. France has provided herself with a connected line of fortifications for a continued defence, an object which does not enter into Germany's calculations; the works at the larger fortified places in France are given a much greater extension than those in Germany, with a view to render investment impossible, and to secure unmolested withdrawal through them of a retreating army. To quote the words of the writer, in comparing the two systems: "The one system is based essentially on the idea of the defensive, which would unite the field armies on the one hand, and the fortresses and territorial army on the other, into a combined system for the protection of the territory within the frontier, and would not shrink from neglecting the field armies, so far as may be required, for the attainment of the general object. The other is the system of a State, whose political situation points to the field armies being maintained as strong as possible for warlike operations beyond its own frontiers, of the greatest possible portion

of the garrison army being made available to reinforce them, and to the fortresses only to allot as many men as are absolutely required for their independent functions." From this clear statement of the two systems it follows that the latter alone is adapted to the spirit of the offensive—which is always encouraged in the German armies, and for which the great results obtained in the past have to be thanked. On the other hand, for the French system it may be claimed that, as a result of the development of firearms, the defence has gained enormously in comparison with the attack, so that it will in future be impossible for the offensive to be undertaken on the same extensive scale as in the past, and the best chances of success will be with the commander who shall utilize the defensive in such a manner as to be able to assume the offensive whenever the occasion offers.

The adoption of "*melinite*" for the breaching of works must have an important bearing on the construction of fortifications and works of defence of every nature in the future. The first experiments with this powerful explosive conducted at Bourges resulted in the bursting of the gun; but subsequent ones at Malmaison gave excellent results. It was reported that at these experiments a single shell containing melinite, bursting on the top of a powder magazine, blew it completely in. As a result of the trials 200,000 of these shells were ordered.

A subject of considerable importance in connection with fortress warfare—and especially in relation to sieges—is the reconstruction of railway bridges, the destruction of which must be reckoned with. Looking to the enormous masses of material to be brought up in the case of siege operations on a large scale, complete railway communication may be said to be indispensable. It is, therefore, of the greatest importance to re-establish the broken communication with the least possible delay. In order to provide for this, the French have introduced portable railway bridges that can be constructed and taken to pieces again, being moved up by rail; the length is 60 metres.

The balloon service has been placed on a permanent organized footing in France, and a central station established at Chalais. It comprises a workshop for studies and experiments, a special arsenal for the preparation of balloons, and a school for the training of men in their management.

The general control of this service is exercised by the General Staff of the War Minister.

In the matter of organization of the personnel in fortresses, France has not been idle either. The complicated nature of the mechanical and technical appliances connected with the fortresses of the present day—and particularly with the enormous guns and their carriages with which the batteries are armed, have led to the general acceptance of the opinion that it is desirable to assimilate the two branches of garrison artillery and engineers, which hitherto have worked independently in fortresses. Germany has not gone so far, but has effected a distinct division of the engineer corps into pioneer and engineer inspections, the former for duties with the field army, and the latter for garrison duty alone. In France a more advanced stage has been reached by the actual amalgamation of the garrison artillery and engineers into 12 engineer regiments, each of 3 battalions with 8 companies of gunners, and 4 of sappers, and their strength has been considerably increased. The change has been generally received favourably, and if the title of the new formations is somewhat of a misnomer, this is to be attributed to the fact that the engineer service has in France always been looked upon as superior to the artillery. As a matter of fact, the attack and defence of fortresses has in modern times come to be an artillery duel on an enormous scale; and all duties connected with it are subordinate to that of placing and working the guns. In an attack in regular form—excepting the last stages, and these, looking to modern experiences, will very seldom involve actual assault—the main duty of the

infantry is to obtain possession of the ground, first at a distance from, and, later on, more close to the fortress, and then to defend it while the artillery establish their positions. The principal occupation of the engineers will be to support the work of the artillery and infantry by constructing appropriate earthworks, and to assist the former, when required, by the construction and use of mines. In the defence it will be the same, except that then the infantry will be occupied in trying to prevent the attacking infantry securing the ground they require. The importance attributed in France to the science of fortress warfare has been further attested by the fortress manœuvres carried out in 1886 at Verdun, Belfort, and Toul, for the purposes of which the greater proportion of the garrison artillery battalions which would be allotted to the garrisons on mobilization were employed.

In Belgium considerable progress continues to be made towards reaching a state of preparation which would, in the event of complications arising between France and Germany, allow of the country assuming a really efficient armed neutrality. In the Budget for the year the sum of 900,000 francs was taken for the arming of twenty field batteries, and the armament of the entrenched camp at Antwerp with guns of heavy calibre; also 150,000 for the armament of Forts Merxem, Zwyedrecht, Cruybeke, Waelhem, Lierre, and Rupelmonde, 80,000 for the completion of Fort Schooten, 450,000 for the construction of a redoubt at Düffel, and 50,000 for the equipment of Fort la Perle, which has been in course of construction since 1873.

In addition to this serious endeavour to place the defensive works of the State in an efficient condition, changes have been made in the strength and calling up of the militia, and steps taken to hasten mobilization. When the system of defensive works projected shall have been completed, Belgium will be a not unimportant factor in certain eventualities.

In a similar manner for many years past Switzerland has striven to improve her defences; but during the past year her efforts in this direction have been much hastened. Since the opening of the St. Gothard line of railway the defence of the southern frontier has been kept in view; but the yearly sum of 87,000 francs allotted for the purpose was barely sufficient to keep in repair the old works that were in existence. But for this year 500,000 francs have been voted as a first instalment of about 2½ millions, estimated to be the sum required to complete the whole project, the execution of which would be extended over five years. The St. Gothard line is of great importance from a mercantile as well as from a strategic point of view; the principal positions to be fortified are those of the Ursern Valley (the meeting point of the Rhone, Reuss, Rhine, and Tessin valleys), and the vicinity of Airolo (on the frontier station of the line, a few miles from the Italian frontier). The former position is to be defended by a number of block-houses, supported by a large work to be constructed at Andermatt; the latter by a block-house west of Airolo, closing the approaches from the Bodretto Valley and from Roveredo, so that both lines can be defended by small forces.

Denmark is also taking part in the general European preparations for war; besides strengthening her army by about 25 per cent. and increasing her fleet, she has in view the covering of Copenhagen by defensive works. The value of these works may be differently estimated. Denmark is not in the same position as Belgium, which has her neutrality to maintain, and in the event of complications with a stronger Power, the maintenance of Copenhagen would not prevent the rest of the country being occupied. On the other hand, Denmark cannot fight without a powerful ally, and the secure possession of Copenhagen would allow of such an ally landing a force for her assistance. The scheme of defence will involve, for works alone, an expenditure of 46½ million crowns, to be distributed over seven years, and to complete them with guns and equipment the sum must be increased to about 80,000 crowns.

Italy maintains her accustomed enterprise in the matter of heavy guns, which, after being tested for some years afloat, are now being introduced on land. Experiments were conducted at Spezzia last year, with satisfactory results, for the testing of plated towers constructed of Grison plates, and some towers ordered, each of which is to accommodate two 100-ton guns. Manœuvres on a large scale were carried out in the attack and defence of a fortress at Verona. The besieging corps was composed of 3 brigades of garrison artillery, with 9 companies and 1 special siege park of 44 guns, with 100 shot and 200 blank cartridges; 4 batteries of field artillery; 6 companies of engineers with an army-corps park, telegraph, 2 traction road engines, and electric light apparatus; 2 brigades of infantry; several squadrons; 1 train company; supply and sanitary services. The defending force consisted of the 8th artillery regiments and 6 companies; 3 companies of engineers; 1 detachment telegraph; balloon park; electric light apparatus; optical telegraph; 2 regiments of infantry and 1 company of Alpine troops, and 1 squadron.

In Russia no special measures have been taken to ensure the technical training of the engineers allotted to fortresses, nor to amalgamate them with the garrison artillery. The 17 existing engineer battalions have 5 companies, and on mobilization the 5th company of every battalion forms 2 reserve companies, which are detached for duties in the fortresses, and on the lines of communications. There are 2 engineer siege parks, at Kief and Dunaborg respectively, at which material is stored in each case for the siege of one fortress. On the other hand, the organization of the garrison artillery is such as to ensure the presence of a numerous and well-trained force of that branch in each fortress. Of the 50½ battalions (besides 7 independent companies) each of the important fortresses of Kronstadt, Warsaw, and Novo-Georgievsk has 6 battalions.

The latest inventions for facilitating fortress warfare in various directions have not been lost sight of in Russia. In several fortresses experiments have been made with the electric light and in the use of balloons for siege purposes. The value of these latter has been in some degree discounted since some experiments made in Germany, which resulted in a captive balloon at the height of 400 metres being destroyed by a field gun firing at an estimated range of 1,500 metres. It would not be so easy to hit a free balloon, but, at the same time, the heavier shrapnel used for sieges contain an enormous number of balls and cover a very extensive area.

Of recent literature on the subject of the present and future conditions of fortress warfare, the most important is General Brialmont's work, "*La Fortification du Temps Présent.*" It was recognized in 1871 that in view of the increased range and enhanced effect of artillery, consequent upon the use of rifled guns, fortresses could only be secured from assault by means of a line of works pushed forward some miles in advance of the enceinte. This would have been most completely achieved by reconstructing the enceinte on the principles recognized as the most suitable for such a scheme; but the enormous cost of the acquisition of land and construction of the new works, as well as the time necessary for this, led to the existing enceinte being maintained. To meet as far as possible in another way the requirements of the situation, detached forts were built on the more important points in advance of the enceinte, and the construction of works in the intervals between them has been postponed until war appears imminent. It was not, however, long before the still advancing progress of artillery necessitated the advanced works being pushed still further forward in advance of the enceinte, which was met by the employment of armour. In fact, looking to the present intensity of fire, and to the extended employment of vertical fire, it may be regarded as impossible that guns can be employed in works and fought long

under fire without special protection. Having this in view, it has even been suggested to abandon the forts in favour of pure infantry positions; but the remedy is rather to be sought in providing for the guns a secure protection, which will allow of their full powers being made use of without the danger of interruption. This can alone be done by the increased use of armour, which is the means of defence most adapted to meet the attack by the artillery of the present day, as formerly casemates were suited to the guns then in use.

This view has been elaborated by General Brialmont, who in his work, already quoted, has advanced a scheme for the construction of a fortress with a perimeter of an extent of 62 kilometres, with 13 forts, each of which is to be armed exclusively of flanking guns, with 6 15-cm. guns in armoured towers, 6 to 21 mortars, and 6 to 8 light wall pieces. The forts are advanced 7,000 metres, with an interval between each of 4,000 metres, in which a permanent armoured emplacement for 6 mortars or short guns is to be constructed. The armoured towers in the forts, 3 in number, are to be disposed 1 at the salient and 1 at either shoulder, so as to form a triangle, and the 6 guns are estimated to be equal in effect to 15 wall pieces. To each 12 guns are also allotted in supporting batteries. The total number of guns amounts to 1,302, and to work them and allow 10 per cent. for losses as many as 12,660 gunners, or about 16 batteries of garrison artillery, would be required. For two such fortresses, and to provide for the requirements of siege operations against an enemy's fortress, 52 battalions would be required.

The section of Colonel v. Löbell's work which treats of the tactics of fortress warfare concludes with a recapitulation of the changes which have taken place or been accepted in principle during the last ten years. These are divided into four heads—the matériel, the personnel, the training of the troops in fortress operations, and their organization. In regard to the matériel, the effect of heavy artillery has been heightened especially by the increased results obtained by improvement in the construction of the projectiles used, partly by shell containing explosives for the destruction of fortified works, partly by the extension obtained for the sphere of action of shrapnel; the use of bombs; the employment of heavy guns in siege operations, &c. The use of pigeons and balloons has been adopted for purposes of communication. Electric lighting apparatus has been supplied to forts and siege-trains; traction engines and cycle machines have been adopted for road work. Armoured protection for the shelter of guns has received an increased development, and is particularly adapted for the construction of a secure observation station for the artillery commander, such as is provided on board armoured ships for the Captain, who issues all his orders from it.

As regards the personnel, the consensus of opinion of those who have discussed the subject and written upon it of late years is in favour of a considerable increase in numbers simultaneously with the amalgamation of the garrison artillery and engineers. The necessity for the increase arises from the danger of entrusting the costly material employed in modern fortresses to the men of the older classes who are called up on mobilization or to Landwehr men of the other arms, in whose hands the working of it might not improbably come to a standstill. Another point to be considered is the training for fortress warfare of those Officers who would in time of war have to do with this and with the employment of the artillery in the attack and defence, which is only to be effected by employing on the General Staff an increased number of garrison artillery and engineer Officers.

The training of the troops in fortress warfare can alone be effected by means of an extensive artillery practice ground, having constructed on it works of permanent fortification for the artillery to fire at, so as to gain the double object of training the gunners while testing the works erected by the

engineers. Exercises would also be carried out there as in war, in the arming of batteries, transport of ammunition, &c.

In regard to organization it is proposed to amalgamate the garrison artillery with the garrison engineers, and form, with an increased strength, one regiment of 3 battalions per army corps, each battalion having 3 artillery and 1 engineer company; a technical artillery and engineer corps would form a separate branch. It is proposed in some countries to form a separate artillery of position, composed of guns and mortars of from 10.5 to 12 cm. calibre, partly to be employed in field operations and partly in the attack of fortresses.

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THE WEIGHT CARRIED BY THE SOLDIER IN THE PRINCIPAL EUROPEAN ARMIES.

(Translated from the Russian by Captain J. WOLFE MURRAY, R.A., D.A.A.G.)

THE following remarks were published in the "Russian Invalide" of the 2nd January, 1887, being an extract from a lecture delivered by Colonel Von der Hofen (a well-known Russian authority upon Continental military matters) at the opening of the Military Sanitary Conference.

Colonel Von der Hofen in his introductory remarks dwells upon the necessity of decreasing the weight carried by the soldier in order to bring him up fresh into the line of battle, to preserve his powers of using the bayonet (note that this consideration is first mentioned), and of aiming steadily. In order to render infantry more mobile, and to preserve their powers, all foreign nations have endeavoured to lighten the loads carried; but this is no easy matter, as the load has to fulfil a twofold object, viz., the purely military requirements such as arms, ammunition, &c., and the demands of supply such as food, clothing, &c.; generally speaking, the efforts made to diminish the weight carried have of necessity tended in the direction of reducing the items under the second heading, both by decreasing the quantities carried, and by improved arrangements for carrying them.

As this question formed one of the objects of the Military Sanitary Congress recently opened at St. Petersburg, Colonel Von der Hofen gives the following interesting statistics as to the weights carried by the soldier in the various armies of Europe, in the hope that they may be of use to the Conference.

The total weight of clothing, armament, and equipment carried by the Russian soldier in 1856 reached $72\frac{1}{2}$ lbs. The alterations from 1874 to 1881 reduced this weight to $63\frac{3}{4}$ lbs. with the short sword, and to $61\frac{3}{4}$ lbs. without the short sword, which is carried in addition to the rifle and bayonet. Finally, with the equipment of 1882, the total weight carried by the soldier was raised to 63 lbs. 2 oz.; but the number of cartridges was at the same time raised by twenty-four. This latter weight cannot, however, be deemed final, and it is desirable to diminish it.

In order to compare the weight of all the articles of equipment of an infantry soldier in the various armies, the following data are given:—

The approximate weight of all articles carried by the soldier are as follows: in Russia 63 lbs. 2 oz.; in Germany about 64 lbs. 2 oz. (according to Morasch's hygiene 72 lbs. $3\frac{1}{2}$ oz.); in France about 64 lbs. (according to other information 63 lbs. $6\frac{1}{2}$ oz.); in Austria about 56 lbs. (according to Morasch 61 lbs. 4 oz.), the weight carried by a regimental pioneer being 68 lbs. $9\frac{1}{2}$ oz.; in Italy about 61 lbs. 4 oz.; in Switzerland about 64 lbs. (according to other information 67 lbs. 11 oz.); in England about 62 lbs. 5 oz.

From the above approximate totals it appears that Austria alone has succeeded in getting down to a weight of 56 lbs., and that the other armies stand in the following order:—Italy, England, Russia, Germany, and France.

Of the above total weight, the following are the amounts taken up by articles of armament pure and simple, such as the rifle, bayonet, scabbard, cartridges, &c.

			Rifle with bayonet and scabbard.	Cartridges.	Total.
			lbs. oz.	lbs. oz.	lbs. oz.
Russia	about	.....	10 3½	7 6	17 9½
Germany	"	.....	12 5	7 11	20 0
France	"	.....	11 4	7 12	19 0
Austria	"	.....	11 0	7 4	18 4
Italy	"	.....	10 10	7 2	17 12
Switzerland ¹	"	.....	12 14	6 5	19 3
England	"	.....	10 5	8 2	18 7

Thus, Russia has the lightest rifle and cartridges, and the Russian rifle is the lightest of all the patterns (the weight of which in other countries is increased in consequence of the awkward heavy bayonet scabbard² adopted with those patterns), and as the Russian cartridge weighs only 613 grains, the soldier can carry 84 cartridges. In Italy the weight of both rifle and cartridge are comparatively small; owing to the weight of the cartridge being only 532 grains, the Italian soldier can carry 88 rounds, and the weight of this number of rounds does not exceed 7 lbs. 2 oz. In England on the other hand the weight of the rifle and bayonet, &c., is comparatively small, but the cartridge is very heavy, weighing as much as 778 grains, in consequence of which the English soldier, though he is burdened with a weight of 8 lbs. 2 oz., is only able to carry 70 cartridges. In Switzerland the magazine rifle with a heavy sword bayonet weighs 12 lbs. 14 oz., but the cartridge is light and weighs only 475 grains, in consequence of which 70 rounds weigh only 6 lbs. 5 oz., this being the number carried by the Swiss soldier. In Austria the weight of the rifle and cartridges does not seem excessively heavy. The weight of an Austrian cartridge is 654 grains, and the soldier carries 70 rounds. The rifle and cartridges in Germany are heavy, where, with a weight of 7 lbs. 11 oz., the soldier can only carry 80 rounds, the weight of each cartridge being 647 grains. Finally, the weight of the French cartridge seems comparatively heavy, as it weighs 676 grains, so that the soldier can only carry 78 rounds.

In comparing the above figures, we can form some idea of the importance of each additional fraction of an ounce in the weight of one cartridge; and if the reduction of the calibre should permit of the diminution of the weight of the cartridge to 460 grains, or thereabouts, the gain in the weight to be carried by the soldier will be very marked. For instance, the English soldier could then carry 70 rounds, as now, but the weight of those rounds would be nearly 4 lbs. 13 oz. instead of 8 lbs. 2 oz. as at present. In France the infantry soldier could carry 78 rounds as at present, but with a weight of 5 lbs. 3 oz. instead of 7 lbs. 12 oz.

This diminution in the weight of the cartridge would make itself equally felt in the reserve ammunition, as for an equal number of rounds a lesser number of vehicles, horses, and personnel would be required.

But if it were found more practical and useful, concurrently with this decrease in the weight of the cartridge, to increase the number of rounds carried, the result would be an appreciable increase to the fighting powers of

¹ Magazine rifle.

² The Russian soldier always carries his bayonet fixed and leaves the scabbard at home when on active service.

the soldier. Thus, in England, for the same weight of 8 lbs. 2 oz., the soldier could carry not 70 rounds but nearly 130;¹ and in Russia, the weight being 7 lbs. 5 oz., the number of rounds carried could be increased from 84 to about 107.

As regards articles of equipment carried by the soldier, the most important are the knapsack and the havresack. The weight of the knapsack fully packed (with the exception of the weight of 40 rounds) is, in Germany, 14 lbs. 2 oz.; in Italy the knapsack packed weighs about 13½ lbs.; and in England the weight of the valise is about 16 lbs. 2 oz. In Austria the weight of the knapsack packed is sufficiently light, viz., 6 lbs. 3 oz.; on the other hand, the weight of the articles of clothing in Austria, such as linen, uniform, great coat, boots, head-dress, &c., weigh about 20 lbs. 1 oz., and the havresack with the supplies carried by the soldier weighs about 2 lbs. 15 oz. The havresack with supplies in Germany weighs 2 lbs. 7 oz., and in the Russian Army 7 lbs. 1 oz.

The mean weight per man carried in the form of entrenching tools is in France 2 lbs. 7 oz., in Germany 3 lbs., and in Italy 4 lbs. 6 oz. The small spade in its case in our Army weighs about 2 lbs., and in Austria 2 lbs. 3 oz.

The weight of clothing, viz., linen, uniform, other articles of clothing, head-dress, and boots in Russia is approximately 17 lbs. 2 oz. (according to other authorities 18½ lbs.). In Germany the total weight is 17¾ lbs., and in Austria 20 lbs. 10 oz. In France the infantry soldier carries a weight of 9½ lbs. in the shape of his campaigning uniform (great coat, tunic, képi, &c.), and in addition to this all the linen, shoes, and several articles of clothing worn by the soldier and carried in the knapsack, together with the havresack and its supplies, weigh about 11½ lbs. To this must be added the weight of the water-bottle filled, of the food, cooking utensils, mess-tin, &c., which altogether amount to nearly 7 lbs. 5 oz. This is the average weight per man, but some men are more heavily weighted. Without going into the details of the remaining articles of camp equipment which are carried by the soldier, and which bring up the total weight to the figures above given, a few remarks will now be devoted to the experiments made in various Continental armies with a view to lightening the load carried by the soldier.

In Belgium, for instance, a special committee has proposed a lighter head-dress, a new knapsack, the weight of which is 2 lbs. 3 oz. lighter than that of the present Belgian pattern, new patterns of a lighter mess-tin, water-bottle, boots, &c., &c. The total gain in weight with these new patterns of clothing and equipment is about 17 lbs. 9 oz. In Belgium the question of lightening the weight of the rifle and cartridges has not been lost sight of, for, according to the latest information, very good results have been obtained with a rifle of 0.315 inch (8 mm.) calibre, and the weight of the cartridge for this rifle has been reduced to 461 grains.

In France also efforts have been made to diminish the heavy load carried by the soldier. Of the measures proposed and recommended in French military literature with this aim in view, the following are worth noting:—The introduction of a rifle of small calibre with light cartridge; the abolition of the second pair of boots and gaiters carried in the knapsack; the abandonment of thirty-two bags per company used for carrying ammunition; the withdrawal of sixty-four mess-tins per company, carried in addition to the light cooking-pots; the diminution of the weight of the knapsack and rifle appliances; the adoption of a short sword-bayonet, &c. The total gain in weight which would be obtained by the adoption of these measures is 8 lbs. 2 oz.

¹ A footnote to General Order No. 161 of 1887 seems to portend the adoption of a 0.298 bore rifle, when the British soldier "will be able to carry 140 rounds for the same weight as that of 70 rounds of the Enfield-Martini rifle."

Much attention has been paid in Germany to the diminution of the weight carried by the soldier. In 1884 a competition was announced for designs of articles of clothing and equipment for the infantry soldier, great stress being laid upon a decrease in the weight of those articles. There were many competitors, and the most suitable designs were handed over to certain battalions for experiment.

The weight gained by the use of these new articles was made up for by increasing the number of rounds carried in the infantry. The infantry soldier will in future carry 100 rounds (instead of 80 as at present), 40 rounds being placed in a third pouch under the outer flap of the knapsack. The great coat, which is now carried *en banderole* over the right shoulder, will, with the new equipment, be folded along the four narrow sides of the knapsack.

As a proof of the ability of the soldier to make longer marches with this new equipment, one of the battalions near Metz, which had the experimental equipment served out to it, in marching to the autumn manoeuvres in 1886, covered 129 miles in four days, at a rate of over 32 miles a day. With the old equipment the average day's march of a German soldier is reckoned at 25 miles. It is to be noted that this battalion carried with it all its ammunition, food, and all articles required for cooking and bivouacking, and that they were not permitted to take up billets or to buy food. The new equipment is to be retained for experiments until October, 1887.

Since the above was written, it appears that the new equipment has been definitely adopted in the German Army. A St. Petersburg paper gives the following as the weight of the various articles:—

	lbs.	oz.
Knapsack	3	14½
Belt	0	14
3 pouches.....	2	4
Boots, per pair	2	10½
Headdress	1	1½
Cooking utensils.....	1	10
Brushes, housewife, &c.	1	6½
Biscuit-bag	0	10½

Adding the weight of the following articles, viz., rifle, 10 lbs. 2½ oz.; 100 rounds of ammunition, 9 lbs. 7½ oz.; bayonet and scabbard, 1 lb. 15½ oz.; linen, great-coat, boots, &c., 15 lbs. 14 oz.; we arrive at a total average weight carried by the soldier of 51 lbs. 15 oz., or in round numbers, 52 lbs.

NOTICES OF BOOKS.

Règlement sur l'Exercice et les Manœuvres de l'Infanterie. Écoles du Soldat, de Compagnie, de Bataillon, et de Regiment. Bruxelles. Imprimerie militaire. E. GUYOT, 1886. Pp. 433. Size $5\frac{3}{4}'' \times 3\frac{3}{4}'' \times 1''$. Weight under $\frac{1}{2}$ lb. Price 4s.

These Regulations take the place in the Belgian Army of our Field Exercise, and it is open to question whether they have not an advantage over it in point of form. They are divided into three parts, each of a convenient size for the pocket, and are formed of pages somewhat smaller than those on which our General Orders and Army Regulations are printed.

Part I treats in the first instance of the general principles of formation in line and column, of the instruction generally of Officers, non-commissioned officers, and men, and the responsibility of the Officers commanding regiments, battalions, and companies for the efficient training of all ranks. The periods of drill in the several stages of individual training, company, battalion, and regimental drills are specified, and the method of passing men from one stage to the next. These general prescriptions are followed by the course of training of the recruit termed *école du soldat*, which is divided under three heads: i. Individual instruction without arms and with arms; ii. Instruction in two ranks at close order; iii. Instruction in skirmishing and open order.

Under the first head is embraced the manual and firing exercises, of which the latter are continued in squads and sections under the second. The instruction in open order is divided into the principles to be taught on the parade ground and their application in the country. The latter portion is admirably arranged, the prime object of such instruction, which is to give the recruit an intelligent interest in the exercises, being constantly kept in view. The general principles are followed by the several stages which succeed each other of necessity in every movement of men, in numbers however small, over unknown ground in the vicinity of an enemy. Its careful reconnaissance is followed by the occupation of the ground according to its nature: the deployment is succeeded by the advance, and it is laid down that on every occasion the supposed enemy shall be represented. The dispositions for receiving cavalry, and the employment of fire according to the distance and number of the enemy, are subsequently treated of, and a plate is attached, showing how cover can be taken advantage of when delivering the fire under various circumstances.

The whole is not a collection of stiff rules and words of command so much as it is a treatise drawn up to enable the instructor to teach the recruit and indicate the logical method of imparting the instruction. The value of such a provision can hardly be overestimated, for it is of great importance to impress the first principles of working in open order up to an enemy upon the instructors themselves, and no less so to ensure from the first the young soldier grasping the subject and understanding what he is about. There is no more lamentable sight than to see men acting in broken ground and in presence of a supposed enemy as if on the barrack square, and though this defect remedies itself very promptly before a real enemy, it is not without some useless losses being incurred. It requires patience no doubt, but the time and trouble devoted to making the recruit understand the why and the wherefore of the instructions given him in this portion of his training will be well repaid later on, by his acting in his company as an intelligent unit, having an object he understands in view, and his own idea as to attaining it.

Part II is devoted to the *école de compagnie*, which is treated under three heads:—i. Instruction of the *peloton* or subdivision; ii. Instruction of the company; iii. Exercises in the attack and defence, and in the construction and employment of field works.

The company is subdivided into three pelotons, the formation and movements of which, in close and open order, are dealt with under the first of these heads. The second provides for the instruction of the company in drill, as distinguished from manœuvre, including the delivery of fire and preparation to receive cavalry.

The instruction under these two heads is preparatory to the third, which prescribes the practical application of the formations and movements learnt to operations in the field. This section commences with a summary of the general rules that should be borne in mind and guide the Officer in the instruction of his company. Some of these are sufficiently important to record. It is laid down, for instance, that the Captain commanding the company is to draw up a regular programme for each drill, that the supposed enemy is to be represented, and that every Officer and sergeant is to be provided with a map of the ground to be worked over. When some progress has been made, the company is to be divided into two portions to be exercised against one another; and ultimately the whole company is to act against a second company, the plans being drawn up by the Major who commands the battalion.

Every exercise is to be concluded by a critical examination on the ground by the Officer commanding, in the presence of the Officers and sergeants, of the movements and eventual situation; and general rules are laid down for his guidance as to faults of more ordinary occurrence which would tell against the success of the operation. These rules are of a general and simple nature, applicable to most circumstances, and are intended only to form a starting point in the criticism, to be supplemented at discretion.

They are as follows:—i. The extent of front of troops engaged must bear a proper proportion to their strength; ii. The different fractions should always have a tactical connection, so as to afford an effective mutual support; iii. Fire delivered hastily without reference to range and object will be judged ineffective; iv. A body of troops engaged in a decisive action, which has no reserve, or engages it prematurely, commits a fault; v. An attack well prepared by fire, and well supported, will be considered successful; especially if the opponent is attacked simultaneously in front and in flank; vi. An attack against well-posted troops maintaining an effective fire, by troops advancing in the open in too close order to allow of their making the most of their fire, or in straggling order without cohesion, will be regarded as unsuccessful; vii. Attacks repeated by the same subdivisions without receiving reinforcement or changing their tactics will be deemed to have failed; viii. Troops that have expended all their ammunition will be put out of action.

The general rules are followed by provisions for the defence of a position, treated under four heads, viz.:—i. Reconnaissance, organization and occupation of the position; ii. Its actual defence; iii. The counter-attack; iv. Pursuit or retreat.

The first of these treats briefly, but clearly, of the selection of the position, placing in prominence the importance of recognizing and providing for the proper protection of the key to it; the necessity for attaining a clear field of fire, and the desirability of being able to take the offensive without difficulty.

The next section deals with the attack of a position, and is equally divided into four phases, viz.:—i. Reconnaissance; ii. Preparation of the attack; iii. Execution of the attack; iv. Pursuit or retreat.

It is particularly directed that as soon as the Captain has decided on his plan of action, he is to communicate it to his Officers and sergeants, pointing out to each the task his portion of the company has to carry out, and the point of assembly in case of failure. In the attack, importance is given to combining a false attack with the real one, and of operating on one of the opponent's flanks. The actual execution of the attack is made clear by admirable plates being contoured plans of selected localities, exemplifying the attack and defence of a position and an action fought to cover the retreat. Sections follow on the defence and attack of a wood, a defile, a farm, and on artillery in position, each contingency being elucidated by a plan similar to those alluded to above.

It may be argued that these minor operations should find their place in a treatise on tactics rather than in the drill book, as their nature does not admit of definite rules being laid down. But, as a fact, it is of great value that they should enter into the early training of the soldier; and it is better that they should be treated for this purpose

on a uniform system under certain general rules, to be applied and augmented according to the special circumstances of each case, rather than that they should be picked out of the many treatises existing on the subject, at the discretion of the instructor.

Again, it may be argued that such an operation as the attack of a battery by a company of infantry, for example, is not one of ordinary occurrence. Neither is it; but the occasion does occur in war, generally under circumstances when prompt action is of the utmost importance, and the fact of Officers and men knowing what they are about will make all the difference in the world as to the result of the attack. The instruction on this operation prescribes an advance in line of subdivision columns, or from a flank of subdivisions, the fighting formation being assumed at from 1,400 to 1,000 metres, to admit of the skirmishers opening fire. Ordinarily, one subdivision will be directed obliquely against the front of the battery, a second against one of its flanks, taking for its objective the battery's escort, if it should have one, while the third is kept in reserve. At first the whole will direct their fire by sections on the guns, and advance by rushes. The portion told off to deal with the escort will not engage its fire before it is forced to. The advanced line will be reinforced early by the supports, the reserve supporting the attack on the escort. If the battery determines to retire, the moment the limbers are brought up, the fire of the line will be concentrated on the teams, and the flanking party will press forward as rapidly as possible. If the battery decides to fight it out, the attack must be persevered in and decided by the bayonet. It is not necessary to be in agreement with every detail of these instructions to recognize the advantage of having at least a general plan known to all ranks. The formation to be assumed at 1,400 metres distance from the battery is an unnecessary detail, whereas an important item is overlooked in not providing for stationary long-range fire before the advance is commenced.

The concluding portion of Part II is occupied with the execution of hasty entrenchments, the defence and the attack of a redoubt. The trace of the several shelter trenches and of the gun-eaulments prescribed do not call for any special remark. It is pointed out that the attack of a redoubt by a single company can seldom occur in war, which goes without saying; nevertheless the practice is considered of value as preparing the company to play its part efficiently as a portion of a larger force. There is something in this, no doubt, for the instruction allows of a careful explanation of the principles governing the attack and defence of a redoubt being imparted to all ranks, and the plates that accompany the instructions make them clear to the dullest intellect.

The 3rd and concluding part comprises the "*écoles de bataillon et de régiment*," the greater portion being taken up with the former of these. The *école de bataillon* is divided into three sections:—i. Movements in close order; ii. Movements in open order; iii. Field manœuvres.

With the exception of the formations in line and column of companies, the whole of the movements and changes of order of the battalion are based on the company column of subdivisions, which tends very much to simplify their execution.

The line formations of these company columns, while manœuvring, are ordinarily at deploying interval, though exceptionally they are closed to three paces distance, which is the formation for assembly. In column, the companies are at the same intervals as the subdivisions. It is laid down that cavalry should as a rule be received without altering the actual formation beyond throwing back the flanks; but at deploying intervals company squares in echelon may be formed.

The attack formation of a battalion acting as a portion of a larger force is the following. On coming within effective artillery fire, estimated at about 3,000 metres, line of company columns at deploying interval is formed; at about 2,500 metres, the preparatory formation for attack is assumed, which consists in sending forward scouts from the flank companies, followed at about 150 metres by these two companies themselves, in line of subdivision columns, which form the advanced line; the remaining companies (Nos. 2 and 3) form the battalion reserve at a distance of about 300 metres. After advancing to about 1,400 metres, the attack formation will be completed by the flank subdivisions of the advancing line advancing and forming a chain; the remaining subdivisions form their reserves.

The battalion reserve closes up to 300 metres from the company reserves. The total depth of the battalion, exclusive of the line of scouts, will then be about 350 metres, and the breadth 300.

In this formation the advance is continued until the fire from the enemy's advanced troops is felt (at about 600 metres in open ground), when the advanced line throws forward its skirmishers and the advance is continued by rushes of alternate companies, covered by the fire of the company halted. The battalion reserve decreases its distance, and when the company reserves have been merged into the chain, one company of the former takes their place.

On arriving at from 300 to 200 metres from the enemy's position, or closer should the ground admit of it, the whole line commences quick fire, the remainder of the reserve moving up to support it in close order. The regiment, of which the battalion is a part, replaces it with a company to meet any attempt at a counter-attack. If the fire poured in does not have the effect of driving the enemy from their position, resort is had to the bayonet.

The portion of Part III which treats of the field manœuvres of a battalion indicates in detail the movements, formations, and several phases in the attack and defence of a village, which are elucidated by excellent plans.

Similar means are made use of to exemplify the principles upon which ordinary earthworks and redoubts should be attacked. General rules are also laid down for the conduct of a battalion forming the advanced or rear guard of a regiment.

The *école de régiment* completes Part III, and treats of the formations, movements, and action of the regiment, the brigade, and the Division. These do not call for much remark, for in the small compass allotted to the subject it has not been possible to do more than indicate the general lines on which the troops will be primarily brought into action. A few points may be noticed, however, regarding the Division. In the first place, when an engagement is imminent and a deployment has been decided on, while the troops are waiting for the orders to carry it out, an extra supply of cartridges is to be issued to every battalion. Secondly, it is directed that the final attack by the infantry is to be supported by the artillery, and there is not to be any hesitation in pushing the guns forward as close as 700 metres from the enemy's position.

The concluding paragraph directs the frequent exercise of the troops in manœuvring one Division against another, rather than in the attack or defence of a previously occupied position; and it is pointed out with much truth that by this means the *coup d'œil* of commanders is practised and improved, and the troops rendered more flexible and handy in manœuvring.

H. H.

The Earl of Peterborough and Monmouth (Charles Mordaunt). A Memoir. By Colonel FRANK RUSSELL, Royal Dragoons. London: Chapman and Hall, 1887. Two Vols. Pp. 717. Size 9" x 6" x 3". Weight under 4½ lbs. Price 1l. 12s.

Many admirers of Charles Mordaunt, the great Earl of Peterborough, have conceived that his name merits being placed in that very short category of world-famous military commanders, the history of whose achievements has outlived their own times; and the publication of a memoir of him, 182 years after the events in which he bore the principal part, gives some colour to such a claim on his behalf. Students of the art of war, who look to the past for their most valuable lessons, must be grateful to Colonel Russell, lately commanding the Royal Dragoons, for his able and scholar-like analysis of Peterborough's character and deeds; and the perusal of this book will go far to afford them an answer to the question as to the position the Earl should occupy in the world's roll of honour. While we hardly think their verdict will be in favour of granting the claim in full, the study of the life of such a man cannot fail to convince them that they ought, at least, to place him far above most of the Generals of the present day.

We believe we are correct in saying that before the production of the work under our notice no separate history of Peterborough had been written, and the available information about him had been scattered through so many volumes that probably very few persons had accomplished the study of his life. We must,

therefore, have credited the author with good service if his task had been merely the putting together in a concise form all the information which could be found concerning a very remarkable man. But Colonel Russell is fortunate in having been able to do more than this, having included in his pages the contents of some hitherto almost unknown papers of great interest. Hitherto, Carleton's memoirs, and the letters of Friend and Stanhope, comprised almost all the original matter known of respecting the military operations conducted by Peterborough, this being embodied in the well-known History of the War of the Spanish Succession by Lord Mahon in such a way that the personal work of the great Earl appears only as a minor incident among the events recorded. For the smaller details of the sieges of Barcelona and the conquest of Valentia we have, indeed, until now depended almost solely on Carleton's account, the authenticity of which was at one period so strongly doubted that certain critics even asserted it to be the work of Defoe and wholly fictitious. The *esprit de corps* of Colonel Russell was naturally, therefore, excited by the discovery and publication of a manuscript from the hand of Colonel de St. Pierre, an Officer who served in the War of the Succession in the very regiment commanded by himself (the Royal Dragoons), from which he has had the greatest satisfaction in not only being able to confirm the authenticity of Carleton, but by supplementing the information given by that author on the war, adding to it further some valuable details respecting the condition of the English Army at the beginning of the 18th century.

It would be beyond the purpose of an article in the Royal United Service Magazine were the personal and political history of Peterborough to be considered further than is necessary to indicate the extent to which the individuality of the man aided in the formation of his character as a soldier; and in studying his life with this object we perceive clearly the reason why with such great abilities he failed in establishing a lasting reputation. For though successful on some occasions on which he was employed as a diplomatist, it cannot be disputed that his political career was on the whole a failure. Wanting in definite purpose, he was as ready as Don Quixote, with whom he has often been compared, to become the champion of a weak and impracticable cause, and his impetuosity, his imperious nature, his eccentricity, and his cynicism combined to militate against the success of any scheme unfortunate enough to gain his advocacy in its favour. Impatient of the least difference of opinion, it was impossible for anyone to act with him as a colleague; and as a subordinate he could not easily subject himself to authority or tacitly obey what his intelligence told him was a mistaken course. As a dictator alone could he succeed, for as such his quick perception, correct judgment, rapid execution, fearlessness of responsibility, and strict integrity caused him to shine out in a very remarkable manner. As a General, therefore, let it be our task to examine his career.

We find him in 1705 accompanying the Archduke Charles of Austria, the claimant for the Spanish throne supported by England, in an expedition to Barcelona. The allied Generals-in-Chief had remained with the main allied army in Portugal, and it does not seem that any strong expectations had been formed that the troops detached to the east of the Peninsula would gain any substantial advantage, the object of sending them being, it would appear, a feint merely intended to cause a considerable portion of the French Army to be withheld from the scene of operations on the west. Peterborough was in equal command with a Dutch General, he was strictly enjoined not to act without the consent of councils of war, from the constitution of which it was known his opinion must be with that of the minority, and, in fact, he was so closely watched that he seemed powerless to do anything on his own authority. There had been, indeed, little in his previous history to warrant the placing of absolute power in his hands, but we may suppose that he had proved himself to be sufficiently conversant with military details to make it safe to trust him, his hands being thus tied, with the command of a small contingent forming part of a secondary expedition. We are able, from the work before us, to appreciate the manner in which, by his abilities and force of character, he was able to so influence the operations as to bring success at Barcelona as well as to make the eastern side of Spain the principal theatre of hostilities during the entire War of the Succession.

Before reaching Barcelona, the fleet bearing the allied force had touched at Denia, a small port in Valentia, having no definite plan of campaign before it. The Earl, perceiving the road to Madrid to be undefended, and that an immediate simultaneous advance of the allied armies from east to west could scarcely fail to place the capital in the power of Charles, advised this course as the one most likely to bring the war speedily to a favourable issue. His advice had no weight with the council of war, but the soundness of it was fully acknowledged when too late. Much time was wasted in wearisome profitless discussion before Barcelona, and it seemed as if all attempt on the place was about to be abandoned, when Peterborough, who was alone in pressing his colleagues to proceed with the siege, managed to get matters into his own hands. His colleagues had so far let him have his own way as to permit him to carry out a night reconnaissance, and although he prepared many details which might have excited their suspicions, but which he led them to believe were only preliminaries for raising the siege, he managed to keep his actual purpose a secret. What then must have been their astonishment to learn that Montjuick, a fort commanding the south side of Barcelona, opposite to the position of the allied troops, had been seized at daybreak by Peterborough himself, and that the fall of the place itself followed speedily. It was then perceived that the details prepared had been those necessary to meet every contingency which was likely to happen, and that the timing of the flank march, the provision of reserves, and the plan of attack had all been most carefully thought out and arranged. It must be acknowledged that this feat, conceived and executed by one man, who used Officers of equal rank as catspaws, keeping them, as well as the Archduke himself, mystified as to his intentions to the last, was one of the most remarkable in the annals of warfare. There was, however, about it that element of hazard and dramatic effect which was peculiar to Peterborough, and the amazing success of his enterprise was insufficient still to induce his colleagues to accept his further counsels. We can well understand his indignation, too plainly expressed, at the long delay at Barcelona which followed the capture of the town. He unceasingly urged, and eventually carried out, his old idea of gaining possession of the province of Valentia with a view to advancing on Madrid. The small allied force was mainly composed of badly-equipped and ill-disciplined troops, a large portion being local irregulars whose loyalty could not be trusted. The Dutch contingent was commanded by Officers filled with jealousy of Peterborough, and he could only thoroughly depend on the very small body of English soldiers, in whose numbers the weak regiment of Royal Dragoons was included. The troops of Philip (the French candidate for the throne) were in excess of the allied force, and their strength was increasing rapidly.

Lastly, the interested personal advisers of Charles used their influence unremittingly to prevent the acceptance of Peterborough's counsels. In face of such difficulties as these, the results achieved by the Earl must ever cause us to wonder. He seems to have made his power felt in the councils of war, and at last to have acted on his own responsibility. Owing to the lightning rapidity of his movements, and to the tactics employed by him being so entirely opposed to the pedantic practices of the day, he out-generalled the enemy at every point. No fatigue or hardship was too great for him, and his indomitable spirit and energy, communicating itself as if by infection to every man in his small army, the number of men seemed, as it were, to be for practical purposes trebled. It was currently said of him that he took walled towns with dragoons, and of his men that every trooper became a hero. The mere intelligence of Mordaunt's approach brought dismay into the hostile camp, and the sudden appearance of a handful of his troopers on a hill top in an unexpected direction would cause an immediate change of the enemy's front. This actually occurred at the relief of San Matteo, when at a moment in which the Spaniards were puzzled as to the direction of the advance and the real strength of Peterborough, he caused fictitious despatches to fall into their hands, leading them to expect an attack in force, with the result that with a strength, it is said, five times that of the Earl, the enemy retreated precipitately.

The conduct of Lord Peterborough towards his opponents was usually chivalric in a high degree, and on one occasion only was it impugned as being less honourable. This was at Murviedro, where, by the crafty manner in which their commander was persuaded to believe in treachery among his Officers, the Spanish force were induced

to hastily abandon a strong position held in such force as to be proof against any attack which the allies could make on it. The action of the English General on this occasion is, very properly we think, defended by Colonel Russell. The incident, which affords a good example of Peterborough's methods, was followed, notwithstanding that the country was occupied by the Spanish troops in preponderating numbers, by the seizure of the important city of Valentia without a blow being struck. The civil administration of the Earl while there was as remarkable as his military exploits had been, and at the same time that he restored order within the city he continued his own peculiar tactics in the province, possessing himself first of the whole artillery train destined for the siege of the fortified city of Valentia, and next defeating the Spanish forces in detail in such an effectual manner as to dishearten Los Arcos, the General, and cause the enemy's forces to be withdrawn over the mountains into Castille, thus ending the campaign for the season.

Peterborough's repose in Valentia was, however, soon disturbed by the news that Barcelona, where the Archduke Charles had remained in person, had been invested by a strong concentration of French and Spanish troops under Marshal Tessé, with whom was Philip of Anjou. The Earl lost no time in returning with his usual impetuosity by forced marches to Catalonia with the small remnant of his contingent, reaching a point a few leagues from the investing army. He was too weak to attack in force, but the manner in which he harassed the French by guerilla operations remains to this day a tradition in the country. The English fleet under Sir John Leake was on its way with reinforcements, but vexatious delays, most irritating at such a moment to Peterborough, occurred in its arrival. The French had mastered the outworks of Barcelona, and might be expected to assault the enceinte and capture the place at any moment. Hours were of precious importance, and the Earl determined, by virtue of his commission as High Admiral, to assert a right to take personal command of the fleet on the instant of its arrival, but this intention he concealed from everyone. He lay two stormy nights in an open boat to intercept Leake, and boarding at night the first man-of-war which arrived he declared his name and hoisted his flag. The astonishment of the sailors when, at daybreak, they found the great Earl had dropped among them as if from the clouds may be conceived. He had wished that only a part of the fleet should be allowed to come into sight at first in order that the blockading squadron of the Count of Toulouse might be tempted to engage, but the caution of Leake in collecting a naval force much stronger than that of the French before he ventured to approach defeated this object, and the French Admiral, alarmed at the sight of the approaching English fleet, ordered the cables of his ships to be cut and escaped to sea. The marine blockade was thus raised suddenly, but Tessé had siege artillery in position and was in command of 25,000 men, while the allied troops, including the garrison of Barcelona and the reinforcements, only numbered 7,000. An assault on the fortification would in all probability have proved successful, but the Earl's arrival and the sudden departure of the French squadron so completely demoralized the besieging army that a panic occurred, and Tessé, abandoning his siege train and camp equipage, retreated in the utmost disorder over the frontier of Roussillon into France.

It would be difficult, remarks Colonel Russell, to give a better illustration of Peterborough's qualities as a military commander and of his strategic skill than the measures he took in connection with the relief of Barcelona. Tessé's retreat has always been considered as most discreditably to him, but it is stated that the principal reason he gave for abandoning the siege was that all the lines of retreat into Spain had been closed by the Earl, and the army as well as the person of Philip were in imminent danger, all reinforcements and supplies except by way of France being cut off.

The withdrawal of Tessé and the inefficient condition of the troops in Spain acting on Philip's side gave the allied forces on both sides of the Peninsula the opportunity of advancing without opposition towards the capital, and the prospects of Charles of Austria at midsummer (1706) were brighter than they had been since the commencement of the war. Castille seemed to be neutral at this time, and Galway and Das Minas with an Anglo-Portuguese force entered Madrid; Catalonia, Arragon, and Valentia declared in favour of Charles, while Philip was a fugitive at

Burgos. A council of war recommended that the Archduke under the escort of Peterborough should proceed at once by way of Valentia to Madrid, and had he done so he might have remained King of Spain. His fatal persistence in ignoring the advice given, and going himself by way of Saragossa, and his irresolution in remaining at that place idle, when any delay in reaching Madrid was a fatal error, were doubtless the chief causes of the subsequent disasters. But he was easily persuaded by his personal attendants that all Peterborough's successes had been mere accidents, and it would be dangerous to hazard his chances on similar wild experiments, while to aggravate matters he was further induced to divide his forces, detaching most of the Spanish and Dutch contingents from the Earl for his own protection. Peterborough could not advance on Castille from Valentia until he knew that the force at Saragossa was advancing from its side, and he expostulated against the unnecessary delay in no measured or courtierlike terms. So much valuable time was lost that the position of the allied troops already at Madrid became by degrees untenable; the unpopularity in Spain of an occupation by Portuguese, and the neglect of Charles to make any endeavour to conciliate the people by his presence, together with the ceaseless intrigues of the French party, combining to estrange the Castillians entirely from the Austrian cause. The small Anglo-Portuguese force was soon in an isolated position and unable to obtain supplies in the country they occupied, the people of which now displayed hostility in every way; the communications with Portugal were intercepted; provisions were beginning to run short, and desertion was increasing; and it became evident that safety could only be assured by effecting a junction with Peterborough. A move eastward was made with extreme difficulty as far as Guadalaxera; where, but for the opportune arrival of Peterborough to their succour at last, after one of his usual rapid marches, the capitulation of Galway and Das Minas would have been inevitable.

The strength of the united allied army had dwindled down to 18,000 men, cramped with disease and without supplies, while the force of Berwick, the only competent opponent met with by Peterborough, had increased to 22,000, and a decidedly hostile disposition had developed towards Charles among the population of Castille. There was no course open to the allies but retirement into Valentia, and this was accomplished without disaster.

A study of the details of the extraordinary variations in success in the campaign of 1706 convinces us that Peterborough was in no sense responsible for its unfortunate ending, but on the contrary affords ample evidence that if his counsels after the raising of the French siege of Barcelona had been attended to, the cause of the Archduke would have attained to a condition highly favourable to ultimate triumph.

At Guadalaxera, the united English contingent had fallen under the command of the senior Officer, the incapable Galway, and from this time the advice of Peterborough was systematically disregarded, the more because it now took the form of a very unusual recommendation, from him, that an inactive and purely defensive policy should be followed until large reinforcements could be obtained from England. He was accused of showing his jealous feeling against the other Generals, and his wish to hinder the success of operations, the credit of which he could not share in. Finding his advice had no longer any weight, and being hurt by all that was said against his motives, he asked for leave to undertake a mission to Italy, and his doing so was hailed as offering a means of disposing of a troublesome man, all the Archduke's advisers and the Generals on his side eagerly advocating that his request should be granted. His departure may be considered the turning point of the fortunes of Charles, for the consequences of the course persisted in by the allied Generals, contrary to his advice, soon became evident.

In 1707, the disastrous defeat of Almanza was followed by the loss of the provinces of Valentia and Arragon, and Lord Galway, whose incapacity had become clear to everyone, resigned the command of the English contingent; the campaign of 1708 was generally unfavourable to the cause of the Archduke; 1709 was uneventful; and although the brilliant conduct of Stanhope was productive of some temporary successes in 1710, Charles only entered Madrid in that year to find that the spirit invoked among the Castillians in 1706 was unconquered, and the triumph of his cause hopeless; and his army commenced to retire into Catalonia for the

winter. On this fatal march, the fortunes of the Archduke collapsed suddenly; the Dutch contingent suffering a defeat and complete rout at Villaviciosa, and the whole of the weakened English force being at the same time surrounded and taken prisoners at Brihuega. A small body of troops remained inactive in Catalonia until 1712, but the war was virtually at an end after these disasters, no further advantage being gained until the Peace of Utrecht in 1713 confirmed Philip in possession of the Spanish Kingdom.

The conduct of the war was a frequent subject of the most heated discussion in the English Parliament for some years, the enemies of Peterborough endeavouring to throw the blame of the issue on him. After a very long enquiry in the House of Lords, a resolution was at length passed in which these words occurred. "Had his Lordship's wise counsels, particularly his advice at the council of war in Valentia, been pursued in the following campaign, the fatal battle of Almanza and our greatest misfortunes which have since happened in Spain had been prevented."

It is a noticeable fact that at the moment when the fame of Peterborough was so completely cleared from the aspersions levelled at it, the Duke of Marlborough had sunk low with the Government and the nation, and it may be well asked why, in our time, the great Duke is accounted as the foremost General ever produced by England, while the name of the Earl is, or has been, almost forgotten. When the relative merits and faults of the two men are weighed together, we can easily comprehend how it was that, during the contemporaneous campaigns in which they were respectively engaged, the fame of the Duke completely overshadowed that of the Earl. Self-assertion will ever temporarily overshadow a modest demeanour, and so it was that Marlborough was the more famous at the time. In his character, we find the strongest stability of purpose displayed in a self-seeking ambition, assisted in its aims by calculating judgment, worldly tact, great unscrupulousness, and a temper which could not be ruffled. In that of Peterborough, on the other hand, we see indolence in general, love of pleasure, capriciousness, eccentricity, impatience of control, neglect of self-interest, indifference to public opinion, but strict integrity, all serving to mask an uncommon genius which showed itself with impetuous excitability but rarely in the brightest flashes. While the one was careful not to miss any opportunity of gaining a step on the ladder of renown, reaching the top slowly and surely, the other, careless of himself, achieved romantic victories in so eccentric a manner as to leave the impression on the minds of men watching him that these were only fortunate accidents happening in spite of all probabilities pointing to failure, but that, after all, reasonable persons must still account him as one to whose care it was dangerous to entrust important interests. But how are we to account for the verdict of the present day? All must admit that the remembrance of Marlborough is kept alive by the fact that his descendants have ever been political leaders, and that the reigning Duke actually occupies a princely residence which recalls the name of Blenheim, his famous ancestor's greatest victory; while, on the other hand, the war of the succession in Spain is a dark page of history which the nation cannot read without a feeling of shame, the name and memory of the only man who did much to redeem that feeling not being even maintained in the person of a representative of the title he honoured. Marlborough's reputation, it must also be remembered, was enhanced by his political career and even more so by the fame of his illustrious Duchess. At the moment when he fell into national disgrace, his cupidity and unscrupulousness had become notorious, but posterity will ever agree to forget individual blemishes of character in considering the life's achievements of a great hero. Thus it is, on the whole, and we cannot but admit the justice of the national verdict, Marlborough stands out prominently to us as a greater man than Peterborough.

In this review, we have only had space to sketch the more prominent events in Peterborough's military career, but we cannot fail to observe that success almost invariably followed operations controlled by himself, while almost with equal certainty the disregard of his advice led to disaster. To quote a few extracts from the words of Colonel Russell, his hero possessed almost all the qualities of a great commander, displaying ingenuity and fertility of expedients wholly inexhaustible; unequalled as a partizan leader, he was no less brilliant in the far-seeing calculations of the strategic art; he excelled just as much in the minor details as in the greater

combinations of war; and he possessed a soundness of judgment and a clearness of perception never found wanting. He achieved amazing results with most inadequate means, and although he engaged in enterprises absurd in their improbability of success, he never met with one single check. If competent military readers agree with even the bulk of these encomiums, the fame of Charles Mordaunt, Earl of Peterborough, as a soldier, can scarcely be allowed to rest in the future where it has been until now.

The private and political life of Peterborough may be followed in the pages of the work before us by those who desire to know more of him. His faults of character were numerous, but in our estimation we can see in him, using the words of an author quoted by Colonel Russell, high and noble qualities running like silver threads through a dark tissue. We can admire while we condemn, for it is plain that he loved justice and liberty and hated wrong and oppression, that he risked life and fortune in his country's service, and in a time of general corruption was never justly accused by his enemies of one sordid thought.

E. R. J.

The Campaign of Sedan, the Downfall of the Second Empire, August, September, 1870. By GEORGE HOOPER, Author of "Waterloo." With Map and Plans. London: Bell, 1887. Pp. 362. Size 9" x 6" x 1½". Weight under 1 lb. 14 ozs. Price 14s. net, cash 12s.

Mr. Hooper is to be warmly congratulated on the success of his latest publication. He has produced an account of the first epoch of the Franco-German War, which is not only thoroughly comprehensible by civilians, but is of real value to those military men who have neither time nor inclination to study it for themselves in that unique but invaluable work, the Official Account. The Official Account has been made the basis of the work, and has been followed by Mr. Hooper accurately and correctly, and he has supplemented this by drawing for information on numerous other sources. His narratives of the battles are excellent. Here and there are stray clerical errors which will doubtless disappear in the future editions which this book is sure to reach. The maps and plans are very clear. It is to be hoped that the book now under notice is but the first of a series treating of the various epochs of the war. Would Mr. Hooper accept a friendly suggestion, if he contemplates bringing out such a series, namely, to avoid sensational writing and sensational headings of chapters? The dignity of military history when in the hands of one able to write such a masterly account of a campaign as that we have before us seems to forbid the employment of the words "Stage Thunder" and "Two Staggering Blows" as headings of chapters containing accounts of the combat at Saarbrücken, and the Battles of Wörth and Spichenen. The "tall writing" in the 10th to the 14th lines on p. 76 is also to be deprecated, and is besides misleading; moreover, there is here an obvious clerical error; but these are mere blemishes on a most valuable and excellent publication which is the best work on the war hitherto written by an Englishman.

L. A. H.

Studies in Troop Leading. The Cavalry Division. By Colonel J. VON VERDY DU VERNOIS. Translated from the German by W. H. Harrison, Quartermaster 4th Battalion the King's Shropshire Light Infantry. Edited by Lieut.-Colonel C. W. Bowdler Bell. With seven Appendices. London: Pp. 424. Size 8" x 5" x 1½". Weight under 1 lb. 2 ozs. Price 5s.

In 1873, little more than two years after the close of the Franco-German War, there appeared a book which literally astounded by the cool audacity of its author those into whose hands it came. It is a matter of history that at the outbreak of that war the cavalry of the IIIrd Army failed somehow or other to carry out the duties which devolve on that arm. And here was an Officer not of cavalry, but of infantry, calmly coming before the military world and taking as his chessboard the theatre of war in which the IIIrd Army moved, playing the game not as it was, but as it ought to have been played. And stranger still, the player still lives professionally, and is now a Lieutenant-General commanding the 1st Division of the 1st Army Corps. But it must

not be supposed that Colonel Verdy du Vernois's work is one of historical criticism. The Colonel used historical facts simply as a foundation for a fictitious narrative in which arise situations which bring before the reader in life-like colours how cavalry works during a campaign, what a commander of a force of the three arms may reasonably expect from his cavalry, and how in detail that cavalry carry on their work. The plan adopted by the author is to narrate the occurrences of each day or of two or three hours of each day in succession, and to follow each period by a most instructive and far-reaching criticism on the conduct of the actors in them from the General and Staff Officers downwards. And owing to the way in which the author has dealt with his subject, the book is one of value to Officers not of cavalry only, but of all arms and all ranks. The younger cavalry Officers will find it rich in instruction for their special work. A perusal of it will convince the field and senior Officers of the importance of the demands which war makes on a cavalry leader, and rouse them to a study of the nature of those demands. Most truly does the author in his concluding page write: "The General commanding a cavalry Division" (and for ourselves we think that for these words might be almost substituted the "Officer commanding any cavalry force covering other arms") "will continually find himself in situations demanding of him profound knowledge of all matters appertaining to the greater operations of war, such as will be required of the General commanding an infantry Division under exceptional circumstances only. The rapidly changing episodes and vicissitudes of a cavalry fight demand the most perfect harmony between troops and leaders, and the highest degree of flexibility and facility in manœuvring. No other combat demands so much talent on the part of a leader as does that of a Division of cavalry, and to our mind there is no more difficult task in the leading of troops." But this book should be carefully studied also by all field Officers, whether infantry, artillery, or engineers, who may at any moment find themselves in command of a mixed force; and which of them may not? In our Army our senior Officers are not as a rule acquainted with the working of any arm but that to which they themselves belong. When an infantry Officer, for instance, finds himself in command of a mixed force, he is absolutely at the mercy of the commanders of his cavalry, artillery, and engineers; he knows nothing about them, and he does not know what he has a right to expect from them, and these commanders are perfectly aware of the fact. A perusal of the work before us will at all events dispel his ignorance as regards his cavalry, and to all field and Staff Officers therefore we commend it for perusal. The maps supplied in the book are excellent and very clear, and although Mr. Harrison may be a first-rate German scholar, he has acted most judiciously as an infantry Officer in securing for his work the imprimatur of one who is so well known as a cavalry Officer and a linguist as Lieutenant-Colonel Bowdler Bell.

L. A. H.

Text-Book of Gunnery, 1887. By Major G. MACKINLAY. London: Printed for H.M. Stationery Office, 1887. Pp. 342. Size $10\frac{1}{4}'' \times 6\frac{1}{2}'' \times 1\frac{1}{4}''$. Weight under $1\frac{1}{2}$ lbs. Price 5s.

The date of the previous edition of this work is 1883, and the many changes and improvements in artillery since even that date renders the issue of this edition almost a necessity if those outside the circle of scientific gunners are to be posted up to date. The book is intended "rather to supply a key to these changes by investigating the broad principles upon which gunnery rests, than to enter into mechanical details in particular cases; it is intended to assist in the formation of a sound judgment, and to enable an intelligent use to be made of means at disposal." Major Mackinlay is well known as a scientific artilleryman, and is Instructor in Artillery at the Royal Military Academy.

Armour and its Attack by Artillery. By Captain ORDE BROWNE, Captain late R. A. London: Dulau, 1887. Pp. 298. Size $10\frac{1}{4}'' \times 6\frac{1}{2}'' \times 1\frac{1}{4}''$. Weight under $1\frac{1}{2}$ lbs. Price 7s. 6d.

Captain Orde Browne is exceptionally qualified both by study and experience to deal with the subject he puts before the public in this work *The History of*

Armour. Calculations in connection with it and the experiments on it are all fully placed before the reader.

Drehbare Panzer für Kanonen in Landbefestigung. Bearbeitet von Franz Klotzmann, K.K. Hauptmann im Genie-Stabe. Wien: E. V. Waldheim, 1887.

This work, which is accompanied by an atlas of beautifully executed and elaborate drawings, is a *résumé* of information on the subject of the use of iron cupolas, turrets, &c. for guns, mortars, and machine-guns applied to land works. It is illustrated with plates copied from Brialmont, Schiemann, and the Report of the Bucharest experiments. J. F. L.

Messrs. Gale and Polden of Chatham are continuing their useful military series in the *Guides' and Markers' Duties in Company, Battalion, and Brigade Movements.* By L. GORDON. Price 2s.; and *Attack Formation as laid down by the Field Exercise.* By Captain J. F. HUME. Price 1s.

Field Artillery, its Equipment, Organization, and Tactics. By Major Sisson C. PRATT, R.A. Second Edition. London: Kegan Paul, 1887. Pp. 282. Size 6 $\frac{3}{4}$ " \times 4 $\frac{3}{4}$ " \times 1". Weight under 14 ozs. Price 6s.

We are glad to see that this useful little work, which is the third volume of Colonel C. B. Brackenbury's Military Handbooks, has reached a second edition. It differs from the first edition only in the additional information given as regards the 12-pr. B.L. gun, and in the omission of the general chapter which dealt with the artillery organization of the future.

The Dark Side of Short Service. By Colonel F. CHRENEVIX-TRENCH, C.M.G. London: Clowes and Son, 1887. Pamph. Pp. 52. Price 1s. 6d.

In this pamphlet Colonel Trench, who has studied the Reserves question carefully, treats of the position and prospects of men of the Army Reserve, the general condition of Army Reserve men, on the policy to be pursued in making use of the Reserve, and of the employment of men of the Reserve. "Boycotted and rejected by all, the Reservist has long ago become nobody's child," says Colonel Trench, and he goes far to prove this startling assertion. The pamphlet deserves a wide circulation and its contents careful study.

Short Tables and Rules for finding Latitude and Longitude by Single and Double Altitudes, Pole Star, Lunars, &c. By A. C. JOHNSON, R.N. London: Potter, 1887. Pp. 43. Size 8 $\frac{3}{4}$ " \times 5 $\frac{1}{4}$ " \times $\frac{1}{4}$ ". Weight under 8 ozs. Price 3s.

This little book is intended solely for the practical navigator. The tables necessary for all the ordinary problems of nautical astronomy are brought within the compass of eight pages, thus saving much trouble and loss of time.

Historical Records of the 79th Queen's Own Cameron Highlanders. Compiled and edited by Captain T. A. MACKENZIE, Lieutenant and Adjutant J. S. EWART, and Lieutenant C. FINDLAY, from the Orderly Rooms Records. London: Hamilton, Adams, and Co., 1887. Pp. 309. Size 8 $\frac{3}{4}$ " \times 6" \times 1 $\frac{1}{4}$ ". Weight under 1 lb. 11 ozs. Price 1l. 5s.

This is a very modest and unambitious production. Yet how many a military *littérateur* would revel in compiling a work which had for its subject a record so full of brave deeds and glorious memories as that of the "Cameron Highlanders."

L. A. H.

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